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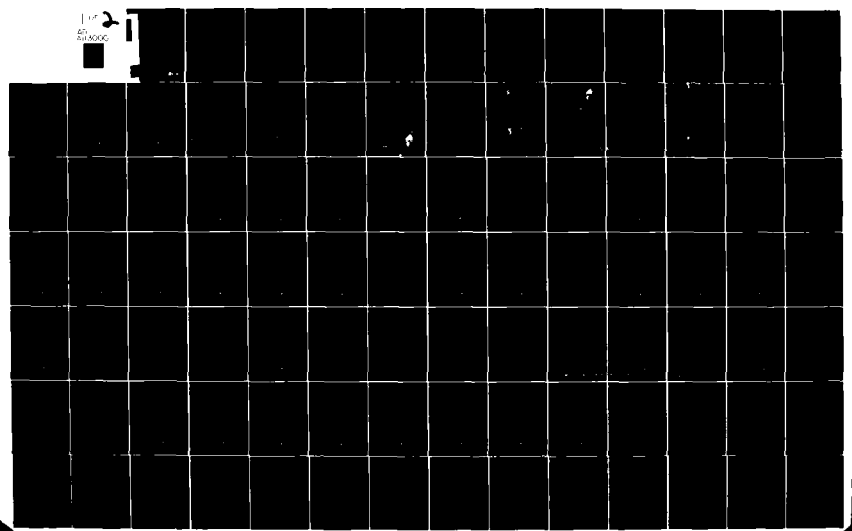

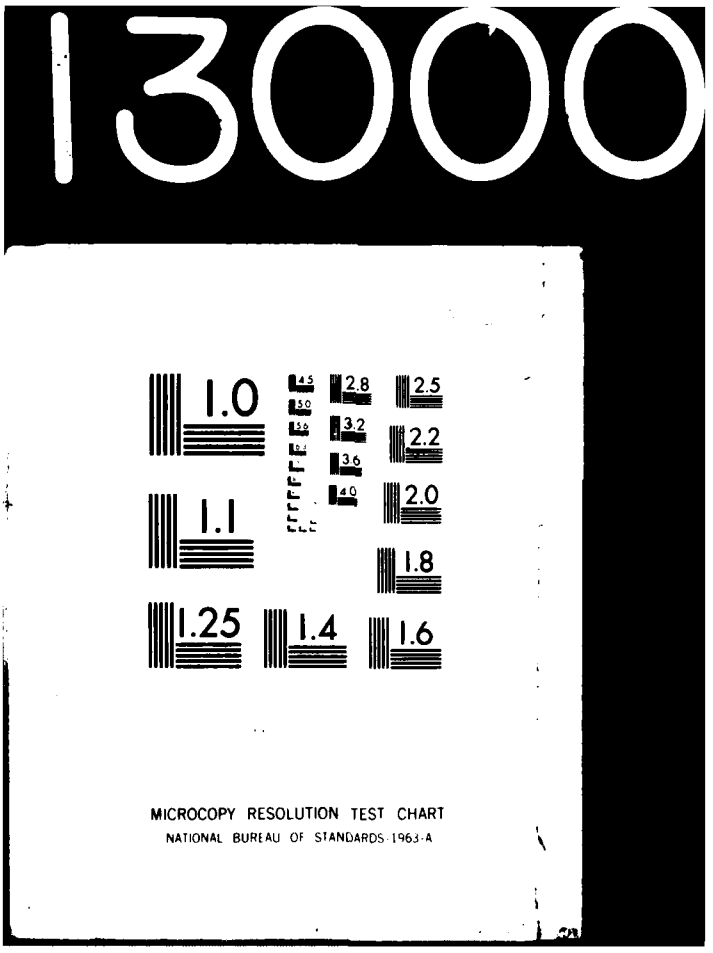
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

MX SITING INVESTIGATION
GEOTECHNICAL EVALUATION

VERIFICATION STUDY
MULESHOE VALLEY, NEVADA
VOLUME II - GEOTECHNICAL DATA

PREPARED FOR
BALLISTIC MISSILE OFFICE (BMO)
NORTON AIR FORCE BASE, CALIFORNIA

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number): This report contains field data & lab test results from the verification investigation @ Muleshoe Valley ~~includes~~ basic data on depth to ground water, depth to rock, seismic refraction surveys, electrical resistivity surveys, ~~core~~ analyses, and soil profiles.

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(1)

MX SITING INVESTIGATION
GEOTECHNICAL EVALUATION

VERIFICATION STUDY - MULESHOE VALLEY
NEVADA

VOLUME II - GEOTECHNICAL DATA

Prepared for:

U.S. Department of the Air Force
Ballistic Missile Office (BMO)
Norton Air Force Base, California 92409

Prepared by:

Ertec Western, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

30 June, 1981

FOREWORD

This volume of geotechnical data was compiled for the Department of the Air Force, Ballistic Missile Office (BMO), in compliance with Contract No. F04704-80-C-0006, CDRL Item 004A6. It contains the field data and laboratory test results from the Verification investigation of Muleshoe Valley. A synthesis of these data are available in Volume I (E-TR-27-MS-I).

The data in each section of this volume are preceded by an explanation of the format and terms used in the compilation.

VOLUME II

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LIST OF FIGURES

TABLE OF CONTENTS (Cont.)

LIST OF FIGURES

TABLE OF CONTENTS (Cont.)

LIST OF FIGURES

TABLE OF CONTENTS (Cont.)

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1.0 ACTIVITY MAP AND GEOGRAPHIC COORDINATES

Explanation: Locations of all field activities are shown in Drawing II-1-1, Activity Location Map (in pocket). The geodetic and Universal Transverse Mercator (UTM) coordinates of all activities are listed in Table II-1-1.

MULESHOE VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	MIN	LONG. DEG	MIN	UTM COORD. ZONE 12 N(KM)	E(KM)
BOMB SITES						
MS- B01	38	22.14	114	44.97	4243.94	696.81
MS- B02	38	12.50	114	49.11	4221.21	690.99
MS- B03	38	14.75	114	45.24	4225.23	694.95
OPT SITES						
MS- 001	38	25.46	114	43.42	4250.14	691.71
MS- 002	38	25.56	114	44.00	4255.32	697.37
MS- 003	38	22.14	114	44.97	4243.94	696.81
MS- 004	38	22.17	114	45.21	4243.96	694.30
MS- 005	38	22.01	114	45.15	4243.75	695.22
MS- 006	38	21.70	114	42.50	4243.37	700.27
MS- 007	38	19.30	114	42.33	4241.94	701.12
MS- 008	38	18.28	114	42.32	4241.95	698.73
MS- 009	38	18.13	114	44.35	4241.53	697.25
MS- 010	38	18.03	114	45.66	4241.41	695.73
MS- 011	38	13.57	114	51.24	4232.87	687.35
MS- 012	38	12.97	114	50.12	4231.81	689.50
MS- 013	38	15.09	114	43.52	4235.77	699.25
MS- 014	38	14.38	114	44.79	4235.52	697.22
MS- 015	38	14.75	114	45.24	4235.23	694.95
MS- 016	38	14.60	114	47.43	4234.91	691.55
MS- 017	38	17.07	114	46.35	4239.31	694.34
MS- 018	38	17.24	114	47.81	4239.73	692.93
MS- 019	38	17.39	114	47.21	4240.19	692.33
MS- 020	38	14.19	114	48.83	4234.11	691.04
MS- 021	38	14.34	114	49.04	4233.82	690.11
MS- 022	38	12.52	114	49.11	4231.21	690.99
MS- 023	38	12.00	114	48.38	4230.27	692.04
MS- 024	38	11.55	114	47.69	4229.27	693.12
GEOLOGIC STATIONS						
MS-GS01	38	12.02	114	50.21	4231.57	689.87
MS-GS02	38	11.80	114	48.05	4229.72	692.62
MS-GS03	38	21.69	114	47.80	4243.53	692.50
MS-GS04	38	20.25	114	45.47	4245.43	695.96
MS-GS05	38	22.16	114	45.71	4243.96	693.42
MS-GS06	38	10.89	114	46.72	4228.04	694.56

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GEODETIC AND UTM COORDINATES OF ACTIVITY LOCATIONS MULESHOE VALLEY, NEVADA

PAGE 1 OF 4

30 JUN 81

TABLE IX-1-1

E-TR-27-MS-II

MULESHOE VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	MIN	LONG. DEG	MIN	UTM COORD. ZONE 12 X(KM)	Y(KM)
MS-0307	38	14.32	114	43.51	4234.37	691.50
MS-0308	38	15.24	114	49.15	4226.33	690.82
MS-0309	38	17.15	114	47.37	4229.50	690.99
MS-0310	38	17.10	114	46.99	4230.71	690.99
MS-0311	38	16.61	114	44.26	4233.75	697.00
MS-0312	38	16.24	114	44.00	4341.76	691.22
MS-0313	38	21.51	114	43.31	4247.30	691.31
MS-0314	38	21.54	114	44.02	4246.25	691.30
MS-0315	38	24.40	114	43.24	4251.24	699.31
MS-0316	38	26.34	114	43.73	4237.16	699.57
MS-0317	38	25.63	114	44.22	4255.44	697.34
MS-0318	38	25.11	114	43.38	4254.46	698.52
MS-0319	38	22.25	114	44.61	4249.17	692.32
MS-0320	38	22.73	114	43.22	4250.19	693.15
MS-0321	38	14.29	114	41.73	4241.44	711.51
MS-0322	38	22.24	114	47.22	4249.25	693.51
MS-0323	38	20.55	114	47.34	4245.93	693.67
MS-0324	38	21.05	114	46.76	4246.87	694.05
MS-0325	38	21.73	114	42.32	4243.29	703.44
MS-0326	38	20.14	114	42.42	4245.34	703.40
MS-0327	38	19.14	114	44.14	4243.43	697.96
MS-0328	38	20.15	114	44.05	4245.35	699.01
MS-0329	38	20.01	114	45.94	4244.97	695.70
MS-0330	38	10.21	114	47.12	4226.98	694.00
MS-0331	38	11.37	114	43.17	4229.91	690.43
MS-0332	38	11.35	114	47.41	4228.90	692.32
MS-0333	38	11.69	114	47.19	4229.54	693.65
MS-0334	38	13.23	114	44.49	4232.49	697.71
MS-0335	38	14.31	114	44.75	4234.47	697.27
MS-0336	38	15.72	114	42.79	4236.41	700.10
MS-0337	38	15.43	114	42.93	4236.61	699.59
MS-0338	38	10.20	114	52.43	4226.61	686.06
MS-0339	38	9.56	114	52.27	4225.43	686.52
MS-0340	38	11.27	114	50.75	4228.27	683.61
MS-0341	38	11.77	114	51.46	4229.55	687.57
MS-0342	38	13.90	114	52.33	4233.49	685.52
MS-0343	38	19.42	114	47.32	4243.92	693.29
MS-0344	38	20.66	114	45.19	4246.21	696.75
MS-0345	38	17.53	114	46.17	4240.38	695.27
MS-0346	38	16.21	114	44.78	4237.99	697.15
MS-0347	38	17.39	114	44.95	4240.15	696.95
MS-0348	38	12.51	114	43.93	4231.00	691.14

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GEODETIC AND UTM COORDINATES
OF ACTIVITY LOCATIONS
MULESHOE VALLEY, NEVADA

30 JUN 81

TABLE II-1-1

MULESHOE VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEC	MIN	LONG. DEG	MIN	UTM COORD. ZONE 12 N(KM)	E(KM)
REFRACTION LINES						
MS- S01	38	25.46	114	43.42	4255.14	698.71
MS- S02	38	22.14	114	44.97	4249.14	696.61
MS- S03	38	18.30	114	42.65	4241.94	700.13
MS- S04	38	15.09	114	47.83	4235.95	689.25
MS- S05	38	11.55	114	47.69	4229.27	693.12
MS- S06	38	13.57	114	51.24	4232.97	687.15
MS- S07	38	25.12	114	42.10	4254.57	701.54
MS- S08	38	11.71	114	48.21	4229.54	692.58
MS- S09	38	14.15	114	45.52	4235.46	696.12
MS- S10	38	10.36	114	46.37	4227.43	695.09
RESISTIVITY LINES						
MS- R01	38	25.46	114	43.42	4255.14	698.71
MS- R03	38	18.30	114	42.65	4241.94	700.13
MS- R04	38	15.09	114	47.82	4235.95	689.25
MS- R05	38	11.55	114	47.69	4229.27	693.12
MS- R06	38	13.57	114	51.24	4232.97	687.15
MS- R07	38	25.12	114	42.10	4254.57	701.54
MS- R08	38	11.71	114	48.20	4229.54	692.58
MS- R09	38	14.15	114	45.51	4235.47	696.12
MS- R10	38	10.36	114	46.37	4227.43	695.09
SURFICIAL SOIL SAMPLES						
MS-SS05	38	22.21	114	43.32	4248.75	698.35
MS-SS06	38	18.28	114	43.52	4241.35	699.73
MS-SS10	38	18.09	114	45.98	4241.41	695.79
MS-SS12	38	12.97	114	50.13	4231.31	689.50
MS-SS13	38	15.09	114	47.52	4235.95	693.09
MS-SS19	38	17.24	114	47.61	4239.79	692.98
MS-SS20	38	14.19	114	48.53	4234.11	691.54
MS-SS23	38	12.02	114	48.32	4230.07	692.06
TEST PITS						
MS- P01	38	25.56	114	44.00	4255.30	697.37
MS- P02	38	24.99	114	42.33	4254.32	700.32
MS- P03	38	21.73	114	42.50	4248.37	700.25
MS- P04	38	18.15	114	44.05	4241.53	697.25

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GEODETIC AND UTM COORDINATES OF ACTIVITY LOCATIONS MULESHOE VALLEY, NEVADA

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30 JUN 81

TABLE IV-1-1

MULESHOE VALLEY ACTIVITY LOCATIONS

ACT ID.	GEODETIC COORD. LAT. DEG	MIN	LONG. DEG	MIN	UTM COORD. ZONE 12 N(KM)	E(KM)
MS- P05	33	14.83	114	44.79	4235.53	697.30
MS- P06	33	14.60	114	47.48	4234.91	693.37
MS- P07	33	17.07	114	46.65	4239.51	694.54
MS- P08	33	11.55	114	47.69	4229.27	693.12
MS- P09	33	10.67	114	51.24	4232.37	687.98
TRENCH SITES						
MS- T01	33	25.46	114	43.42	4255.14	696.71
MS- T02	33	22.17	114	46.01	4248.96	694.30
MS- T03	33	22.14	114	44.97	4248.94	695.61
MS- T04	33	13.30	114	42.68	4241.94	700.13
MS- T05	33	14.75	114	46.34	4235.23	694.95
MS- T06	33	12.52	114	49.11	4231.01	690.99
MS- T07	33	14.04	114	49.63	4233.80	690.11
MS- T08	33	17.39	114	48.22	4240.05	692.09
WATER WELL SITES						
MS- W01	33	13.09	114	46.37	4241.41	695.19

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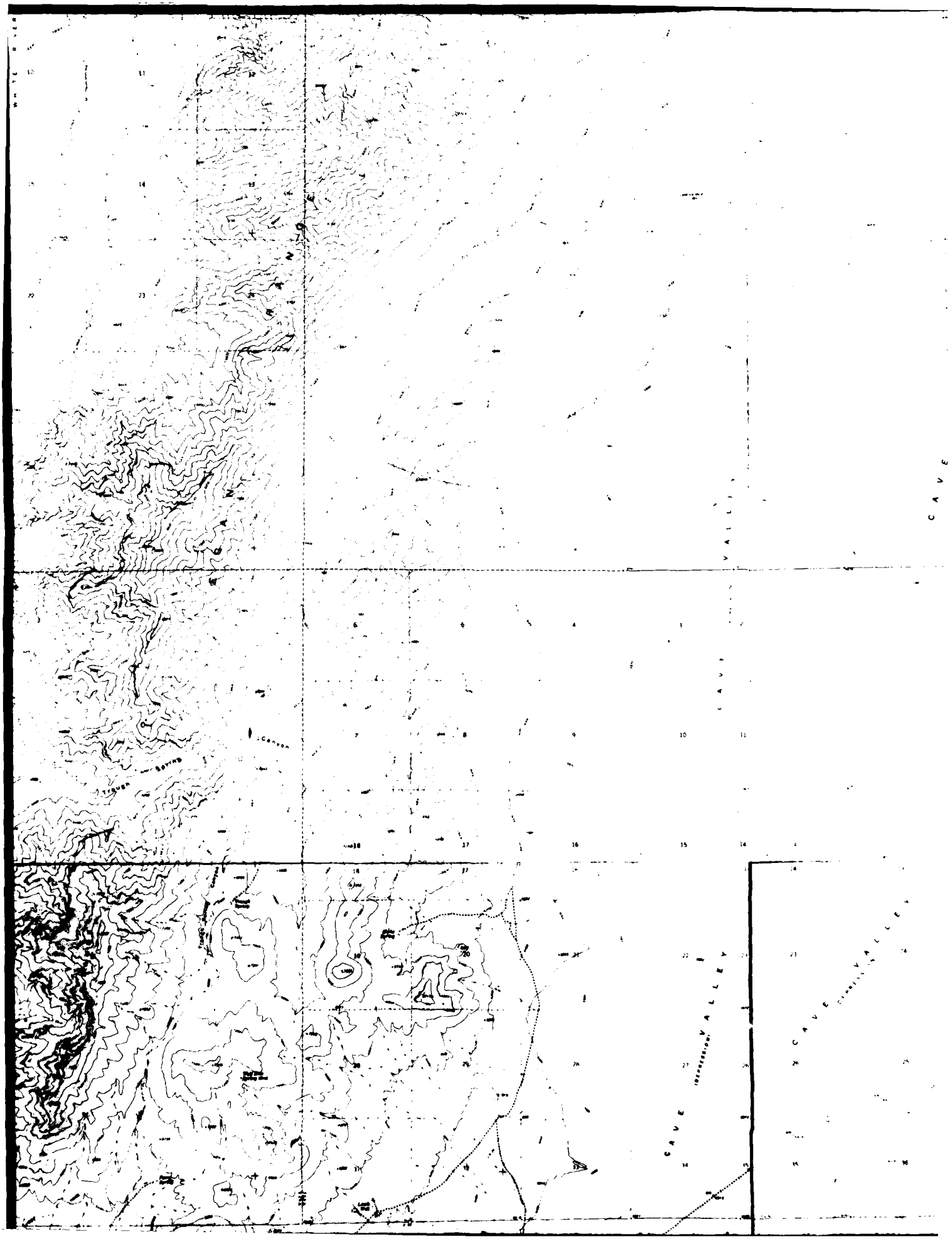
GEODETIC AND UTM COORDINATES
OF ACTIVITY LOCATIONS
MULESHOE VALLEY, NEVADA
PAGE 4 OF 4

30 JUN 81

TABLE II-1-1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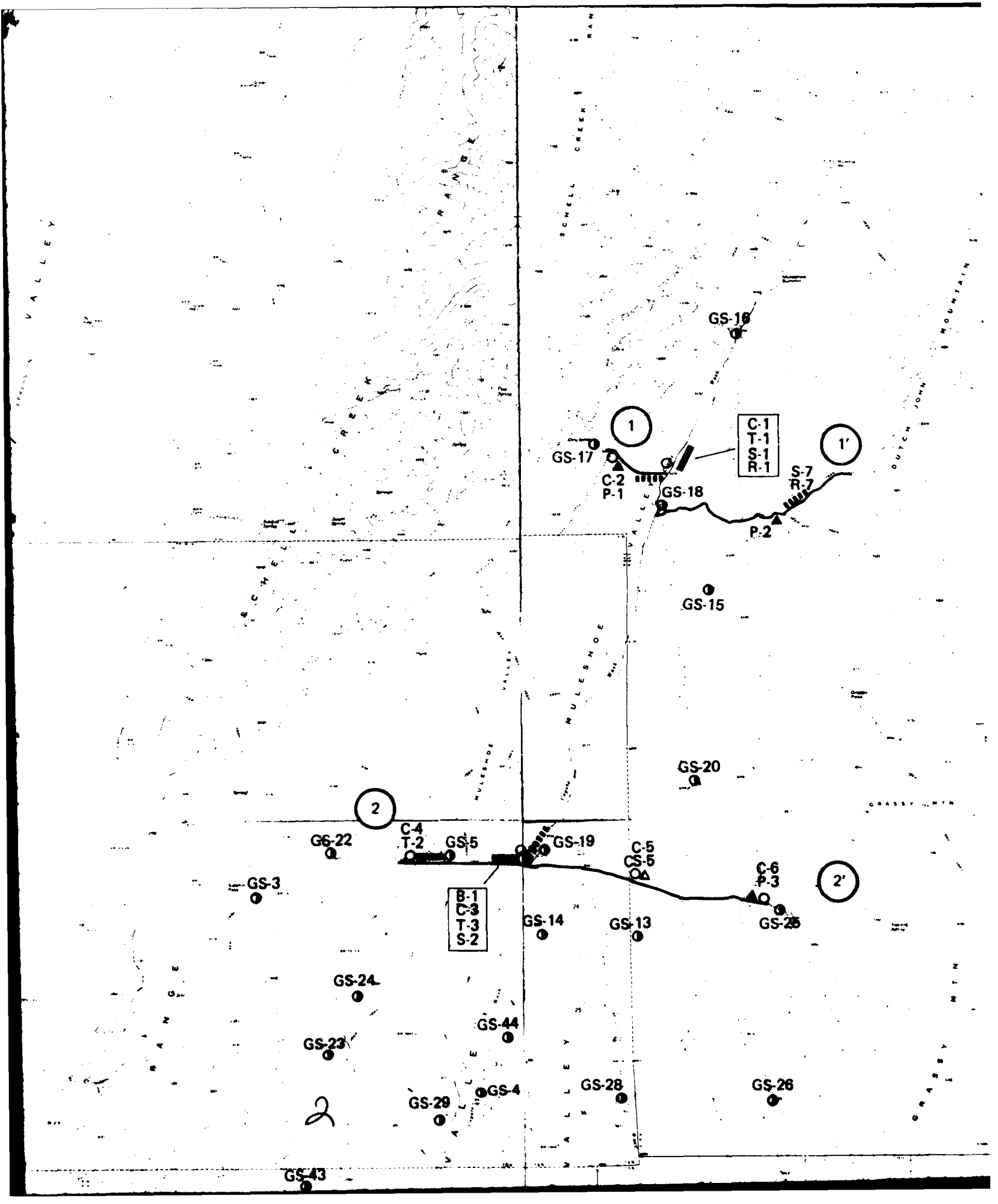
CAVE VALLEY
CAVE VALLEY
CAVE CANYON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S-1
R-1
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GS-17
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GS-18
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R-7
P-2
GS-15
GS-20
2
C-4
T-2
GS-22
GS-5
GS-19
C-5
CS-5
C-6
P-3
2'
GS-3
B-1
C-3
T-3
S-2
GS-14
GS-13
GS-25
GS-24
GS-44
GS-23
GS-4
GS-28
GS-26
GS-29
GS-43


DUTCH JOHN MOUNTAIN
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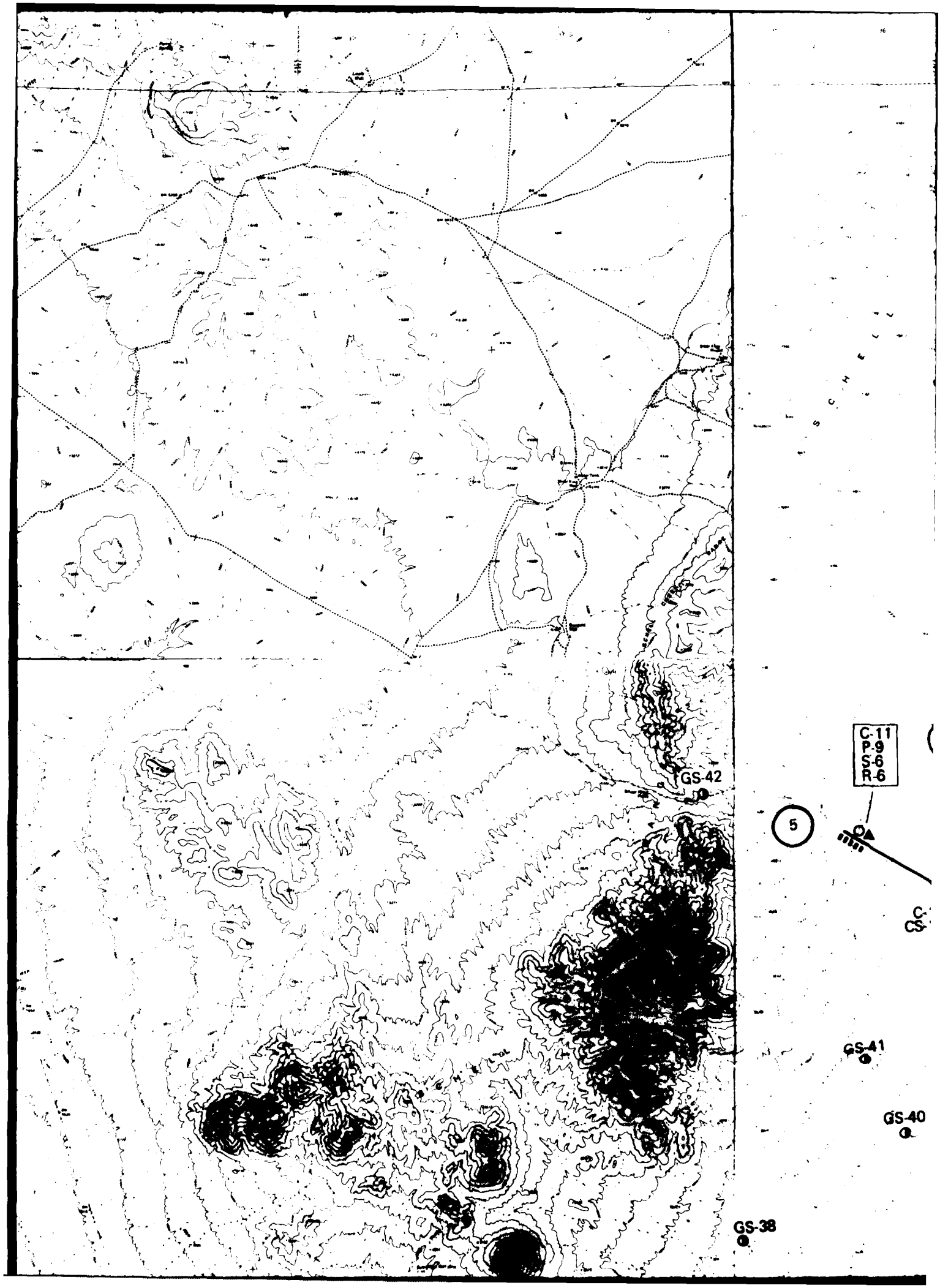
LAKE VALLEY
(DEPRESSION)
GRASSY MTN
GRASSY MTN
DEPRESSION
3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P-9
S-6
R-6
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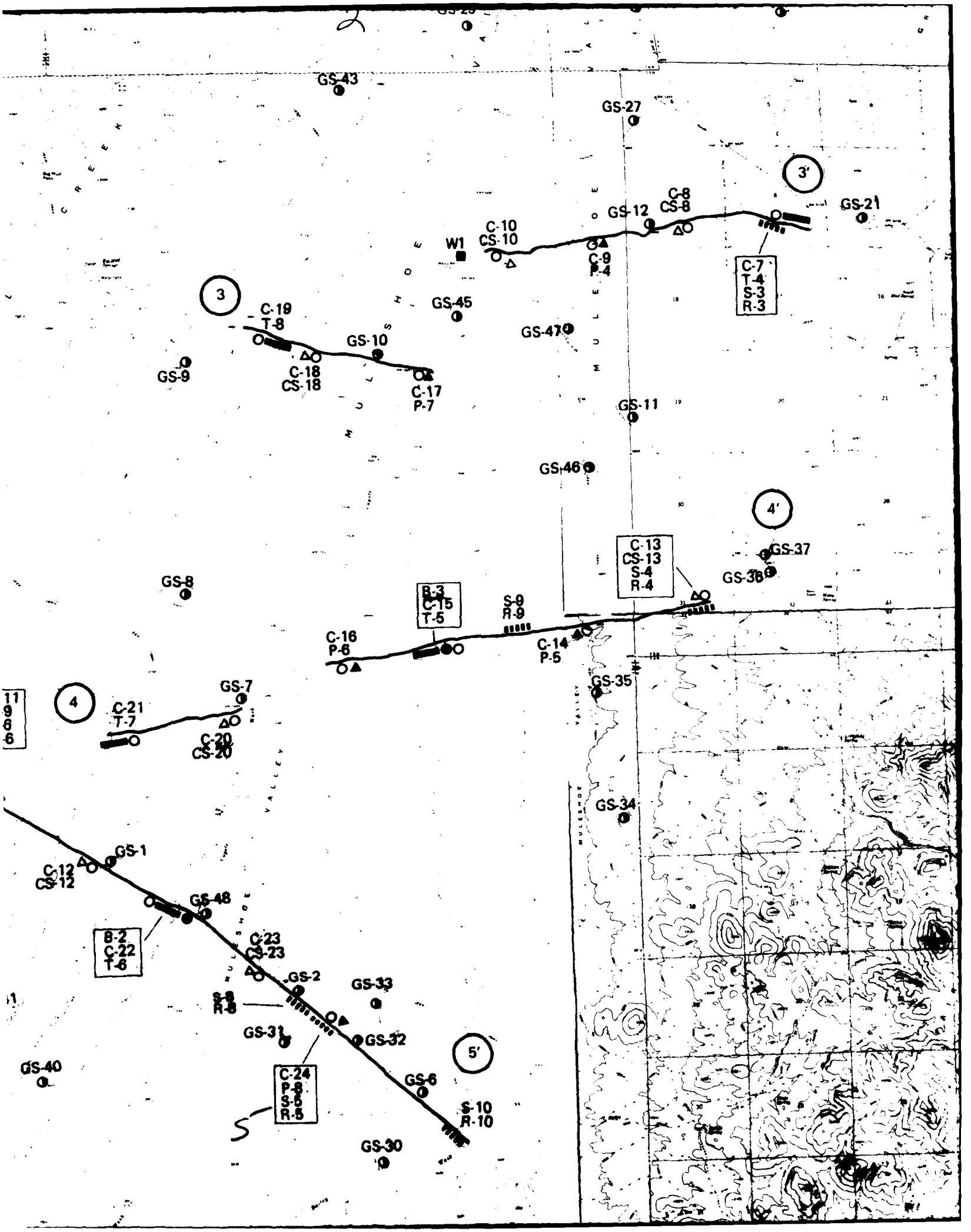
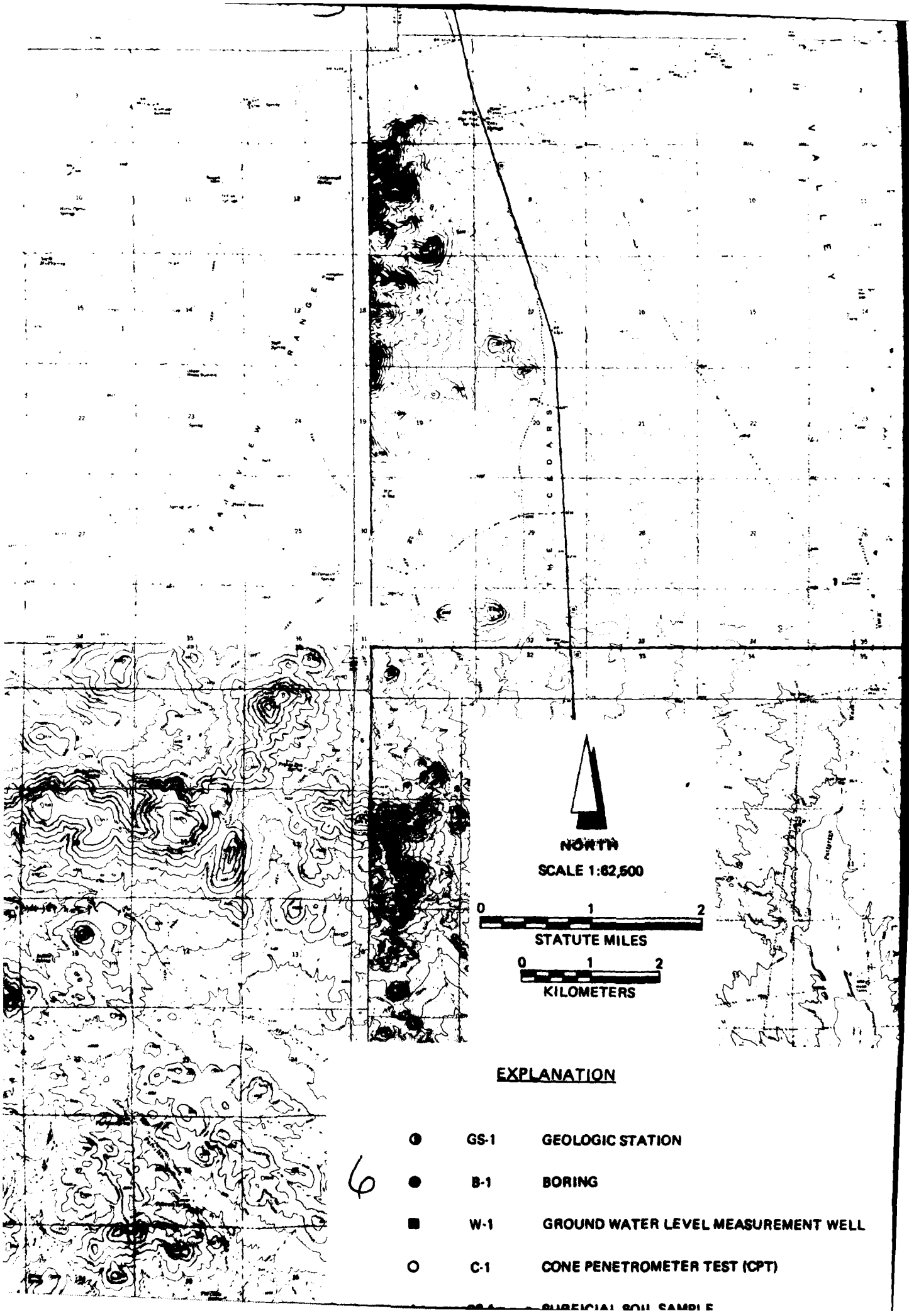
GS-42
GS-41
GS-40
GS-38


GS-43
GS-27
3'
C-8
CS-8
GS-12
GS-21
C-10
CS-10
W1
C-9
P-4
C-7
T-4
S-3
R-3
3
C-19
T-8
GS-45
GS-47
GS-10
GS-9
C-18
CS-18
C-17
P-7
GS-11
GS-46
4'
C-13
CS-13
S-4
R-4
GS-37
GS-36
GS-8
B-3
C-15
T-5
S-9
R-9
C-16
P-6
C-14
P-5
GS-35
4
GS-7
C-21
T-7
C-20
CS-20
GS-34
GS-1
C-12
CS-12
GS-48
B-2
C-22
T-6
C-23
CS-23
GS-2
GS-33
S-8
R-8
GS-31
GS-32
5'
GS-40
C-24
P-8
S-6
R-5
GS-6
S-10
R-10
GS-30


NORTH
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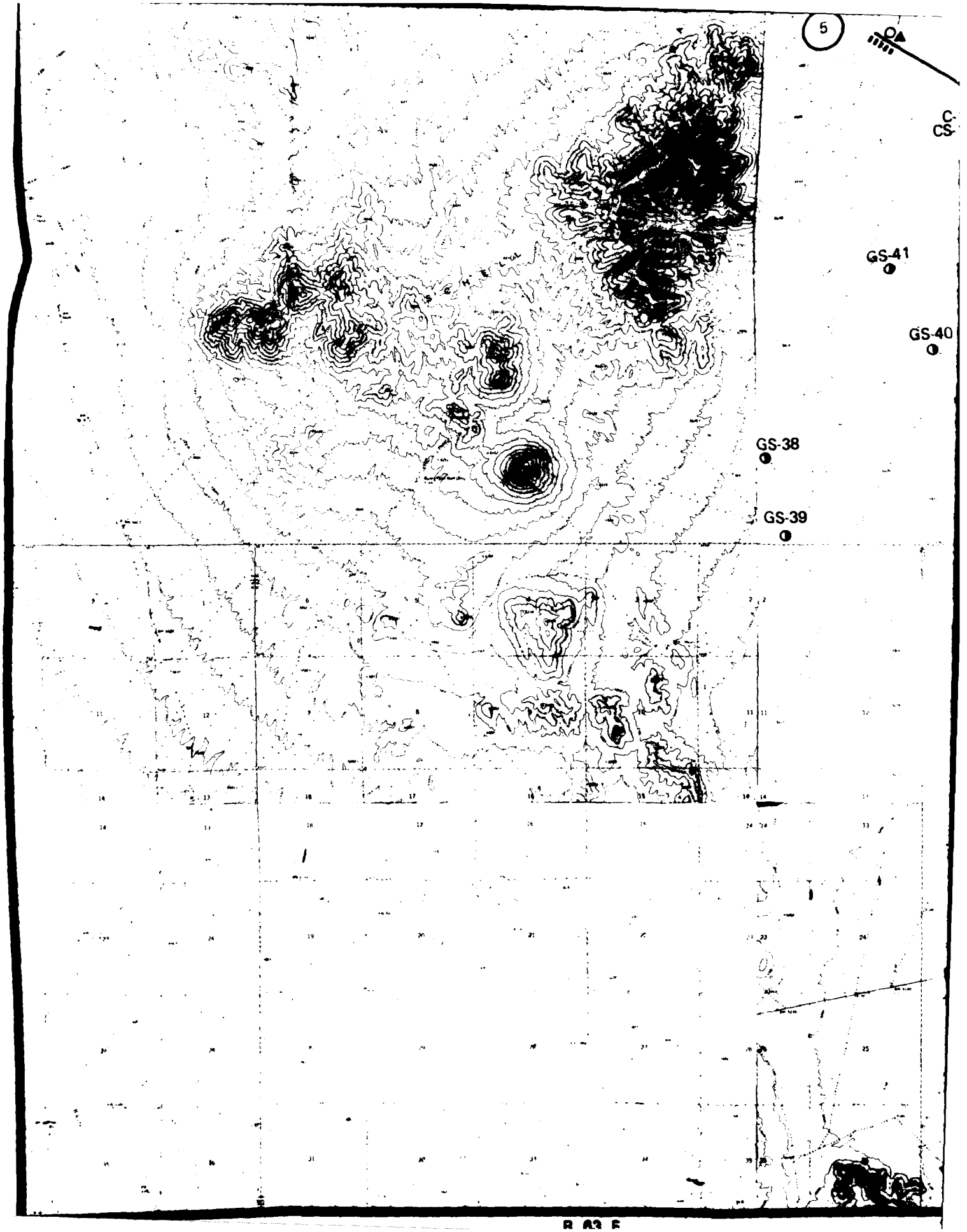
STATUTE MILES
0 1 2
KILOMETERS
EXPLANATION
GS-1 GEOLOGIC STATION
B-1 BORING
W-1 GROUND WATER LEVEL MEASUREMENT WELL
C-1 CONE PENETROMETER TEST (CPT)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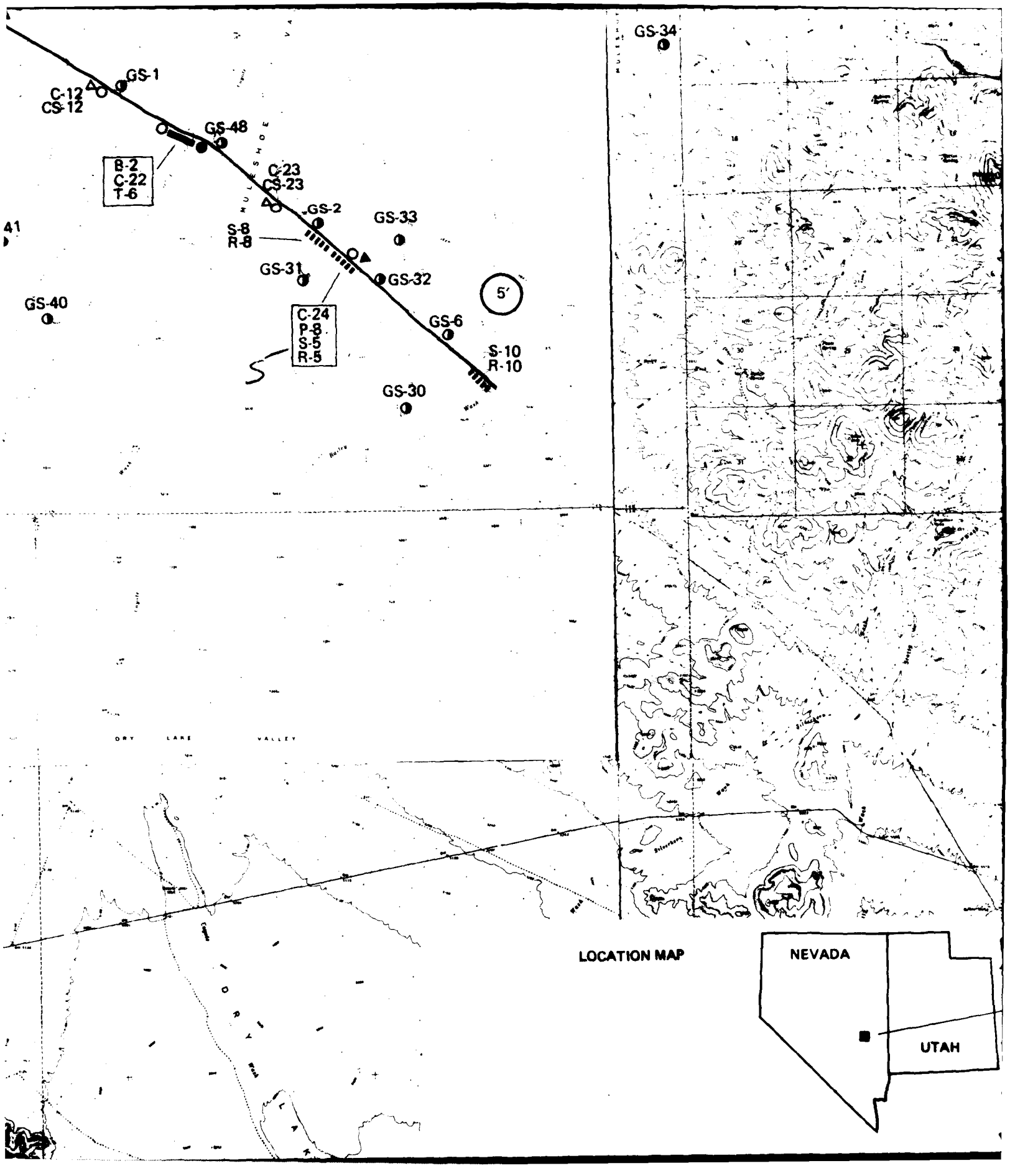
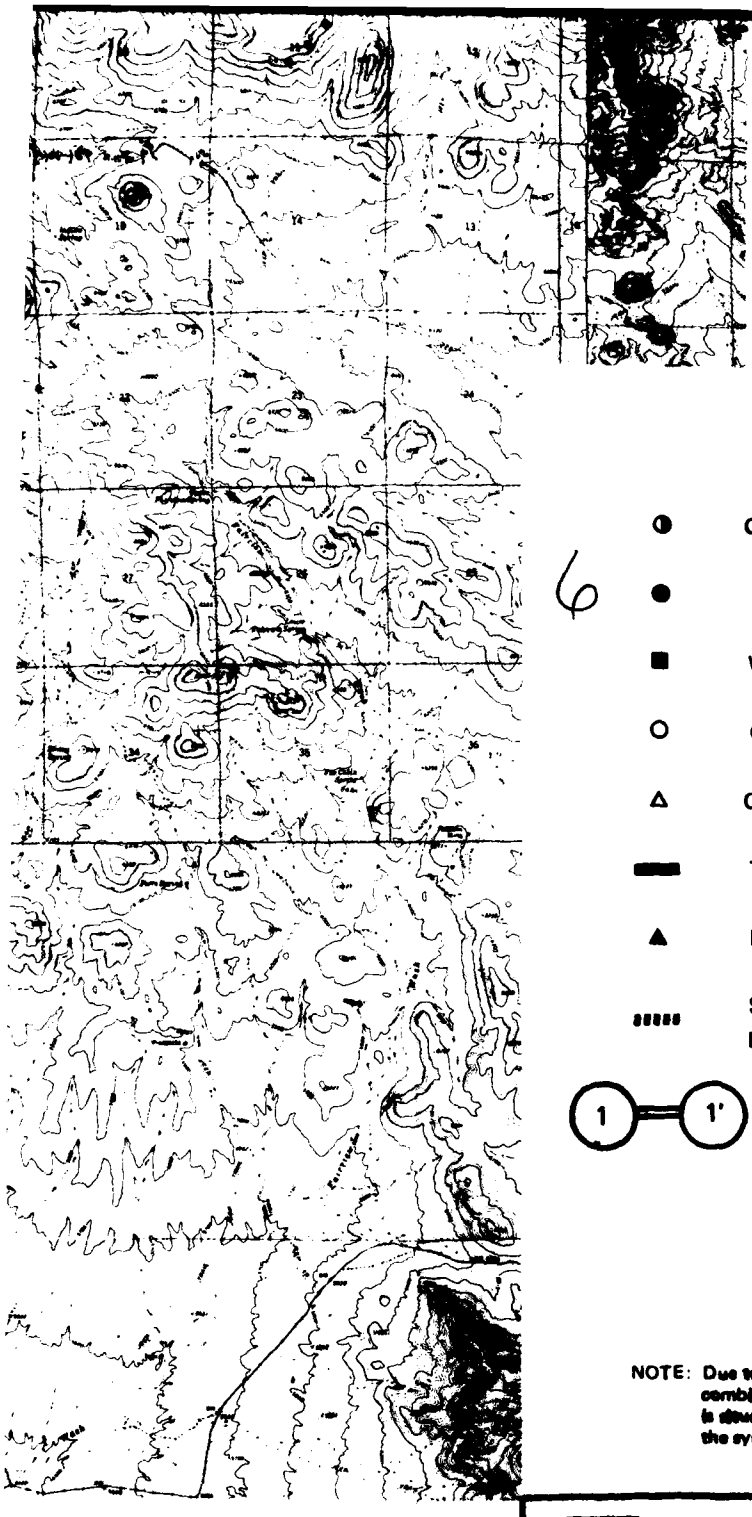
GS-41
GS-40
GS-38
GS-39


GS-1
C-12
CS-12
GS-48
B-2
C-22
T-6
C-23
CS-23
GS-2
S-8
R-8
GS-33
GS-31
GS-32
5'
GS-40
C-24
P-8
S-5
R-5
GS-6
S-10
R-10
GS-30
GS-34
41
HULLSHOE
DRY LAKE VALLEY
LOCATION MAP
NEVADA
UTAH



NORTH

SCALE 1:62,500

0 1 2

STATUTE MILES

0 1 2

KILOMETERS

EXPLANATION

◑	GS-1	GEOLOGIC STATION
●	B-1	BORING
■	W-1	GROUND WATER LEVEL MEASUREMENT WELL
○	C-1	CONE PENETROMETER TEST (CPT)
△	CS-1	SURFICIAL SOIL SAMPLE
▬	T-1	TRENCH
▲	P-1	TEST PIT
▪▪▪▪▪	S-1	SEISMIC REFRACTION LINE
	R-1	ELECTRICAL RESISTIVITY LINE
1 — 1'		ACTIVITY LINE

NOTE: Due to the exaggeration of the map symbols, the exact location of any combination of activities is where either the boring (1st) or the CPT (2nd) is situated. Single activities are most accurately located nearest the center of the symbol.

VERIFICATION STUDIES FY 80

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ACTIVITY LOCATION MAP
MULESHOE VALLEY, NEVADA

30 JUN 81

DRAWING II-1-1

2.0 GEOLOGIC STATION DATA

Explanation: Geologic stations were established at selected locations throughout the valley at which detailed descriptions of surficial basin-fill deposits or rock were recorded. All data taken on surficial basin-fill units at the geologic stations are listed in Table II-2-1, and an explanation of the column headings in the table is given below. An example of the field data sheet is shown on Figure II-2-1. At stations where rock descriptions were made, only geologic unit designations are listed. A general explanation of all geologic unit symbols used in Verification studies is included at the end of this section.

Column Heading Table II-2-2	Explanation
Station Number	Geologic stations are numbered sequentially. (e.g., NMSG001; N= Nevada-Utah Study Area; MS= Valley abbreviation [Muleshoe]; G= Geology Station).
Geol. Unit	Generalized mapped geomorphic unit (see explanation below). The grain-size designations (s, g, and f) indicate sand, gravel, and fines, respectively.
MPS (mm)	Average Maximum Particle Size in millimeters.
Grain Size (%B, %C, %G, %S, %F)	Estimated particle size distribution using the Unified Soil Classification System. Percentages of boulders (%B) and cobbles (%C) are based on the entire deposit, whereas percentages of gravel (%G), sand (%S), and fines (%F, are taken only on the fraction composed of particles less than 3 inches (76 mm) in diameter. Note: The symbol, Ø (occasional), indicates between one and five percent; zero indicates 0 to one percent.

*	Laboratory analyses of selected soil samples using the Unified Soil Classification System.
USCS	Soil class according to the Unified Soil Classification System.
Munsell Color	Soil color based on standard Munsell Soil Color Charts.
Source Rock Types	Rock types of coarse clasts (gravel) listed in order of abundance.
Physical Properties	Data listed in columns 6 through 15 address specific soil properties. These are listed below in parentheses following the column heading number and are also listed at the bottom of Table II-2-1. Data are coded with each numerical entry referring to a specific soil condition as listed below.

6	(Grain Shape)	1) Angular, 2) Subangular, 3) Subrounded, 4) Rounded, 5) Well rounded
7	(Moisture Content)	1) Dry, 2) Slightly Moist, 3) Moist, 4) Very Moist, 5) Wet
8	(Plasticity of Fines)	1) None, 2) Low, 3) Medium, 4) High
9	(Consistency)	Coarse grained: 1) Very Loose, 2) Loose, 3) Medium Dense, 4) Dense, 5) Very Dense Fine grained: 1)Soft, 2) Firm, 3) Stiff, 4) Hard
10	(Structure)	1) Non-stratified, 2) Stratified, tabular, 3) Stratified, other (lensed, cross bedded, discontinuous beds)
11	(Cementation-Induration)	1) None, 2) Weak, 3) Moderate, 4) Strong
12	(Depth to Cemented Layer)	Depth to layer (in centimeters) exhibiting cementation-induration described in Column 11 (above)
13	(Weathering of clasts)	1) Fresh, 2) Slight, 3) Moderate, 4) Very

14 (Soil Profile Development)	1) None (A-C profile), 2) Poor (incipient B-horizon), 3) Well (prominant B-horizon)
15 (Caliche Development)	1) None, 2) Stage I, 3) Stage II, 4) Stage III, 5) Stage IV
Terrain	Terrain information at the data location is broken into the following categories:
Drainage Depth (ft)	Average depth of drainages (in feet)
Drainage Width (ft)	Average width of drainages (in feet)
Slope (%)	Average slope of ground surface (in percent grade)
Sample	Number of samples taken

GENERALIZED GEOLOGIC UNITS

Explanation

Surficial Basin-fill Units

A1 Younger Fluvial Deposits - Major recent stream channel and floodplain deposits.

A2 Older Fluvial Deposits - Older incised stream channel and floodplain deposits in elevated terraces bordering major recent drainages. Note: Not mapped in Muleshoe Valley.

A3 Eolian Deposits - Windblown deposits of sand occurring as either thin sheets (A3s) or dunes (A3d).

A4 Playa and Lacustrine Deposits - Deposits occurring in modern, active playas (A4) or in either inactive playas or older lake beds and abandoned shorelines associated with extinct lakes (A4o).

A5 Alluvial Fan Deposits - Alluvial deposits consisting of debris flow and water-laid alluvium near mountain fronts, grading into predominantly water-laid alluvium deposited in shifting distributary channels near the basin center. Younger (A5y), intermediate (A5i), and older (A5o) alluvial fans are differentiated by surface soil development, terrain conditions, and present depositional/erosional environment.

Grain sizes of these deposits (except A3 deposits, which are exclusively sandy) are indicated by a single letter (f, s, or g) following the geologic unit symbol. These letters indicate the predominant grain size and range of soil types according to the Unified Soil Classification System.

f - fine-grained clays and silts (ML, CL, MH, CH)

s - sands (SP, SW, SM, SC)

g - gravels (GP, GW, GM, GC)

ROCK UNITS

I Igneous (undifferentiated). Rocks formed by solidification of a molten or partially molten mass.

- I1 Intrusive - Plutonic rocks formed by solidification of molten material beneath the surface (e.g., granite, granodiorite, diorite, gabbro).
- I2 Extrusive (intermediate and acidic) - Volcanic rocks of intermediate and acidic compositon formed by solidification of molten material at or near the surface, (e.g., rhyolite, latite, dacite, andesite).
- I3 Extrusive (basic) - Volcanic rocks of basic composition, generally formed by solidification of molten materials at or near the surface (e.g., basalt).
- I4 Extrusive (pyroclastic) - Rocks formed by accumulation of volcanic ejecta (e.g., ash, tuff, welded tuff, agglomerate).

S Sedimentary (undifferentiated) - Rocks formed by accumulation of clastic solids, organic solids, and/or chemically precipitated minerals.

- S1 Arenaceous and/or Siliceous Rocks - Composed of sand-size particles (e.g., sandstone, orthoquartzite) or of cryptocrystalline silica (e.g., opal, chert).
- S2 Carbonate Rocks - Composed predominantly of calcium carbonate detritus or chemical precipitates (e.g., limestone, dolomite, chalk).

S3 Argillaceous Rocks - Composed of clay and silt-sized particles (e.g., siltstone, shale, claystone).

S4 Evaporite Rocks - Precipitated from solution as a result of evaporation (e.g., halite, gypsum, anhydrite, sylvite).

S5 Coarse Clastic Rocks - Composed of gravel sized or larger clasts (e.g., conglomerate, breccia).

M Metamorphic (undifferentiated) - Rocks formed through recrystallization in the solid state of preexisting rocks by heat and pressure (e.g., gneiss, schist, hornfels, metaquartzite).

STATION NUMBER	GEOL UNIT	MPS MM	GRAIN SIZE XB	XC	XG	XS	XF	USCS	MUNSELL COLOR	SOURCE ROCK TYPES	PHYSICAL PROPERTIES 6	7	8	9	10	11	12	13	14	15	TERRAIN DRAINAGE(FT) DEPTH	WIDTH	SLOPE (%)	SAMPLE
MSGS001	ASIG							GM																0
MSGS002	ASIS																							0
MSGS003	ASIS	23	0	15	15	65	20	SM	10.0YR3/3	S2 I	2	5	2	3	1	1		3		3	5.0	3.0	2	0
MSGS004	A1 F		0	0	0	5	95	ML	10.0YR3/3			3	3	8	1	1			1	1	7.0	10.0		1
MSGS005	ASIS	85	0	0	2	93	5	SP-SM	10.0YR3/3	I2 S2	2	3	1	3	1	2	20	3	1	4				0
MSGS006	ASOS	120	0	0	15	75	10	SP-SM	7.5YR4/4	I2	2	3	2	3	1	2	26	3	2	4	7.0	13.0	3	1
MSGS007	A1 S	1	0	0	0	65	35	SM	10.0YR4/4		3	3	2	3	1	1			1	1				1
MSGS008	ASIG	120	0	10	50	35	15	GM-SM		S2 I2	2	3	2	2	1	4	25	2	2	5	7.0	50.0		0
MSGS009	ASIS	90	0	5	10	85	5	SP-SM	7.5YR4/4	S2 I2	2	3	2	3	1	3	58	2	3	4	25.0	3.0	2	0
MSGS010	ASIS	110	0	0	5	75	20	SM	10.0YR4/3	S2	2	3	2	2	1	3	70	2	1	4	8.0	33.0	2	1
MSGS011	ASIS	6	0	0	0	75	25	SC	7.5YR4/6		2	3	3	3	1	1			3	1			2	1
MSGS012	ASOS	200	0	5	20	70	10	SP-SM	10.0YR3/4	I2 S2	2	3	2	3	1	3	41	3	2	4	13.0	70.0	1	0
MSGS013	ASIS	80	0	0	20	60	20	SM-SC	10.0YR4/4	S2 I2	2	5	2	3	1	4	20	2	1	5	10.0	20.0	3	0
MSGS014	ASYS	20	0	0	0	70	30	SM	7.5YR5/4		2	1	2	3	1	1		2	1	1	1.0	3.0	1	0
MSGS015	ASIS	90	0	0	10	70	20	SM	10.0YR3/3	S2	2	3	2	2	1	2	40	2	2	4	8.0	10.0	5	0
MSGS016	ASIS	110	0	0	40	55	5	SP-SM	10.0YR3/3	S2 I2	2	3	1	2	1	1		2	1	3	3.0	7.0	4	1
MSGS017	S2																							1
MSGS018	ASIS	85	0	0	5	80	15	SM	10.0YR3/4	S2	2	1	1	2	1	3	20	2	2	4	10.0	70.0	6	0
MSGS019	A1 F		0	0	0	15	85	ML	10.0YR4/3			1	3	7	1	1			1	1	8.0	200.0	0	0
MSGS020	ASOS	25	0	0	5	80	15	SM	10.0YR3/4	S2 S1	2	1	2	2	1	4	35	2	2	5	16.0	200.0	2	0
MSGS021	I2																							1
MSGS022	S2																							1
MSGS023	ASIS	75	0	0	15	70	15	SM	10.0YR3/4	S2 I3 I4 S1	2	1	3	3	1	3	20	2	2	4			1	0
MSGS024	ASOS		0	0	10	80	10	SP-SM	10.0YR3/4	S2 S1	2	1	2	3	1	1		2	2	2	2.0	3.0	2	0
MSGS025	ASIS	85	0	0	20	55	25 *	SM	10.0YR3/4	S2 S1 I4	2	1	2	2	1	3	27	2	2	5	20.0	250.0	6	1
MSGS026	ASIS	310	0	5	30	55	15	SM	10.0YR3/4	S2 S1 I4	2	1	3	3	1	1		2	2	3	7.0	80.0	8	0
MSGS027	ASIS	20	0	0	10	75	15	SM	10.0YR4/4	S1 S2	2	1	2	3	1	4	15	2	2	5			2	0
MSGS028	ASIS		0	0	10	75	15	SM	10.0YR4/4	S2 S1	2	1	2	2	1	4	27	2	2	5			2	0
MSGS029	ASIS	70	0	0	5	80	15	SM	10.0YR3/4	S2 S1 I2	2	1	2	2	1	3	23	2	2	5	8.0	35.0	0	0
MSGS030	A2 S	25	0	0	5	90	5	SP-SM	5.0YR3/4	I2	2	1	1	4	1	1		2	3	2			2	0
MSGS031	I3																							1
MSGS032	ASIS	45	0	0	5	70	25 *	SC	7.5YR4/6	I2	2	3	3	4	1	1		2	3	2			2	1
MSGS033	ASIS	65	0	0	10	65	25 *	SM	10.0YR3/4	I2 I3	2	1	1	3	1	3	25	2	2	5			1	1
MSGS034	ASIS	15	0	0	0	95	5	SP-SM	5.0YR3/3		3	1	1	4	3	1		2	1	1			1	0
MSGS035	ASOS	120	0	5	5	85	10	SP-SM	10.0YR4/4	I2 S2 I3	3	1	2	2	3	4	40	2	2	5			0	0
MSGS036	I2																							1
MSGS037	ASIS	30	0	0	0	95	5	SP-SM	5.0YR3/3		3	1	2	4	1	1		2	2	1			1	0
MSGS038	ASIS	75	0	0	30	60	10	SP-SM	10.0YR5/4	S2 I3 S1	2	1	2	3	1	3	24	2	1	4	7.0	33.0	6	0
MSGS039	ASIS	100	0	0	10	80	10	SP-SM	10.0YR4/4	S2 S1 I2	3	1	2	3	1	1		2	1	3	3.0	7.0	4	0
MSGS040	ASIG	140	0	0	55	35	10	GP-GM		S2 S1	2	1	3	3	3	2	32	2	1	4	3.0	20.0	4	0
MSGS041	ASOS	37	0	0	10	75	15	SM	10.0YR4/4	S2 S1	2	1	1	3	1	4	55	2	1	5	2.0	33.0	8	1
MSGS042	S2																							1
MSGS043	ASOS	65	0	0	10	75	15	SM	10.0YR4/4	S2 S1	2	1	2	2	1	4	38	2	1	5	25.0	450.0	6	0
MSGS044	ASIS	35	0	0	0	95	5	SP-SM	10.0YR4/6		3	1	1	4	1	1		2	1	2			1	0
MSGS045	ASYS	25	0	0	5	90	5	SP-SM	10.0YR4/4	I2 S1	1	1	1	3	1	1		2	1	2				0
MSGS046	ASIS	45	0	0	0	97	3	SP	10.0YR5/4		3	1	1	2	1	3	40	2	1	4	13.0	380.0	2	0
MSGS047	ASOS	80	0	0	5	92	3	SP	10.0YR4/4	I2 S1 S2	3	1	1	3	1	3	30	2	2	3	3.0	40.0	2	0
MSGS048	A1 S	45	0	0	0	55	45	SM			3	1	2	3	1	1		2	1	2			1	1

EXPLANATION: PHYSICAL PROPERTIES

6: GRAIN SHAPE	9: CONSISTENCY	12: DEPTH TO CEMENTED LAYER(CM)	15: CALICHE DEVELOPMENT
7: MOISTURE CONTENT	10: STRUCTURE	13: WEATHERING OF CLASTS	NOTE: O=OCCASIONAL(1-5%)
8: PLASTICITY OF FINES	11: CEMENTATION-INDURATION	14: SOIL PROFILE DEVELOPMENT	NOTE: *=LAB DATA

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GEOLOGIC STATION DATA
MULESHOE VALLEY, NEVADA

30 JUN 81

TABLE II-2-1

CSB|VALLEY|CLM STATION #
1 2 3 4 5 6 7

Station No. _____ Described Geol. Unit _____ UNIT 8 9 10 11

Date _____ Complete Geol. Unit _____

Observers _____ Field Photo Nos. _____

Air Photo No. _____ Sample (No=0, Yes=1) 12 _____

SOIL PROPERTIES

MPS | B | C | S | F
13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

1. Grain-Size Distribution: MPS (mm) - grain size of coarsest fraction; boulders and cobbles - percent of total; gravel, sand, and fines - percent less than 3 inches.

2. USCS Symbol 28 29 30 31

3. Descriptive Name (one adjective only) _____

4. Munsell Color (not applicable to gravel) 32 33 34 35 36 37 38

5. Lithology of gravel, cobbles, boulders: give rock type (I1, I2, M, etc.) in order of abundance. 39 40 41 42 43 44 45 46 47 48

6. Grain Shape (coarse grained soil only): 1) Angular, 2) Subangular, 3) Subrounded, 4) Rounded, 5) Well-rounded. 49

7. Moisture Content: 1) Dry, 2) Slightly moist, 3) Moist, 4) Very moist, 5) Wet 50

8. Plasticity of Fines: 1) None, 2) Low, 3) Medium, 4) High 51

9. Consistency:
Coarse-grained: 1) Very Loose, 2) Loose, 3) Medium Dense, 4) Dense, 5) Very Dense
Fine-grained: 6) Soft, 7) Firm, 8) Stiff, 9) Hard 52

10. Structure: 1) Non-stratified (homogeneous), 2) Stratified-tabular, 3) Stratified-other; if 3) describe _____ 53

11. Cementation-Induration: 1) None, 2) Weak, 3) Moderate, 4) Strong 54

12. Depth to Cemented Layer (cm) 55 56 57

13. Weathering of boulders, cobbles, and gravel: 1) Fresh, 2) Slight, 3) Moderate, 4) Very 58

14. Degree of Soil Profile Development: 1) None (A-C profile), 2) Poor (incipient B-horizon), 3) Well (prominant B-horizon) 59
Describe _____

15. Degree of Caliche Development: 1) None, 2) Stage I, 3) Stage II, 4) Stage III, 5) Stage IV 60
Describe _____

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FIELD DATA SHEET
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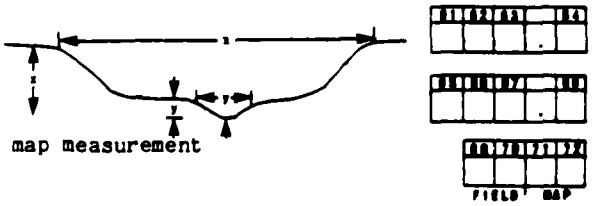
FIGURE II-2-1

TERRAIN

16. Average Drainage Depth (ft)

17. Average Drainage Width (ft)

18. Slope (percent) - field and/or topo map measurement



SURFACE FEATURES

19. Pit Depth (cm) _____

20. Thickness of Vesicular Silt (cm) _____

21. Desert Pavement Development
(None, Poor, Moderate, Well) _____

22. Patina Development
(None, Moderate, Well) _____

COMMENTS

_____

_____

_____

_____

ROCK DESCRIPTIONS

23. Rock Type/Formation _____

24. Color, Grain size, Hardness, Texture _____

_____

25. Degree of Weathering _____

26. Structure
Bedding Characteristics _____

Bedding Attitude _____

Fracture, Joint _____

27. Secondary Alteration/Mineralization _____

_____

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FIELD DATA SHEET
PAGE 2 OF 2

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FIGURE II-2-1

3.0 GROUND-WATER DATA

Explanation: The only ground-water data available for Muleshoe Valley was a single boring recorded by the State of Nevada Engineer's Office. These data were updated where possible from measurements taken during Ertec EWI's field operations. All data are shown in Table II-3-1. The location of the borehole in which the water-level measurement was attempted is shown in Drawing II-1-1. The well number listed in the left-hand column of Table II-3-1 refers to the well location shown on Drawing II-1-1. The actual well number giving location, according to the Bureau of Land Management Land Survey System, is shown in the second column.

WELL NO.	WELL LOCATION NUMBER*	ELEVATION OF GROUND SURFACE - FEET (METERS) ABOVE M.S.L.	DEPTH OF WELL - FEET (METERS)	WATER LEVEL			REFERENCES**/ REMARKS
				DEPTH BELOW GROUND SURFACE - FEET (METERS)	DATE MEASURED	ELEVATION - FEET (METERS) ABOVE M.S.L.	
W-1	5N/64E-11cbd	5680 (1731)	290 (88)	dry	5 - 80	<5390 (1643)	1

*MOUNT DIABLO BASELINE AND MERIDIAN

**REFERENCES:

1. ERTEC WESTERN MEASUREMENT

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GROUND – WATER DATA
MULESHOE VALLEY, NEVADA

30 JUN 81

TABLE II-3-1

4.0 SEISMIC REFRACTION DATA

Explanation: Each figure shows seismic wave travel times plotted versus surface distance between the energy source (shot) and the detector (geophone) for a single seismic line. Distances are measured along the line from geophone number 1 which is designated as zero distance. Distances to the right (on the paper) of geophone 1 are positive. The direction arrow gives the approximate direction of the geophone array from geophone 1 to geophone 24.

Travel Time Versus Distance Graph (Upper Half of Figure)

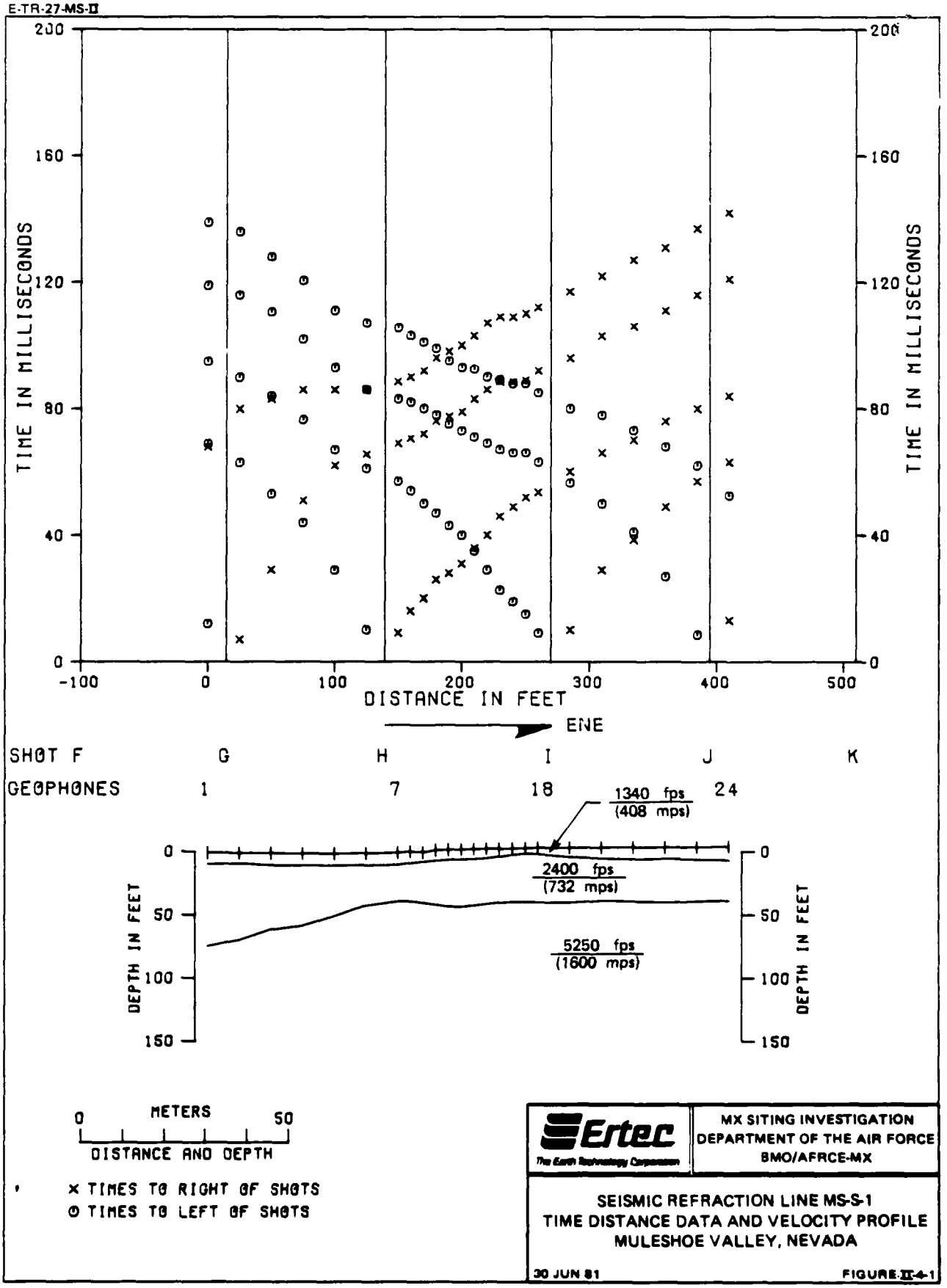
On this graph, the abscissa represents distance; the ordinate, time. The six vertical lines represent the locations of shots (designated as F, G, H, I, J, and K). The symbol "X" denotes travel times at geophones that were located to the right of a shot. The symbol, ⊙, denotes travel times that were located to the left of shots.

Velocity Cross Section (Lower Half of Figure)

This is an interpreted velocity cross section beneath the seismic line. The top line represents the ground-surface profile. The short vertical lines crossing the top line mark the geophone positions. The depth scale is plotted relative to a point on the line which was arbitrarily chosen as "zero elevation" at the time the line was surveyed. The additional lines across the cross section represent the interpreted boundaries between layers of material with different compressional wave

velocities. These boundaries are commonly called "refractors." The velocity interpreted to be representative of each layer is shown.

E-TR-27-MS-II



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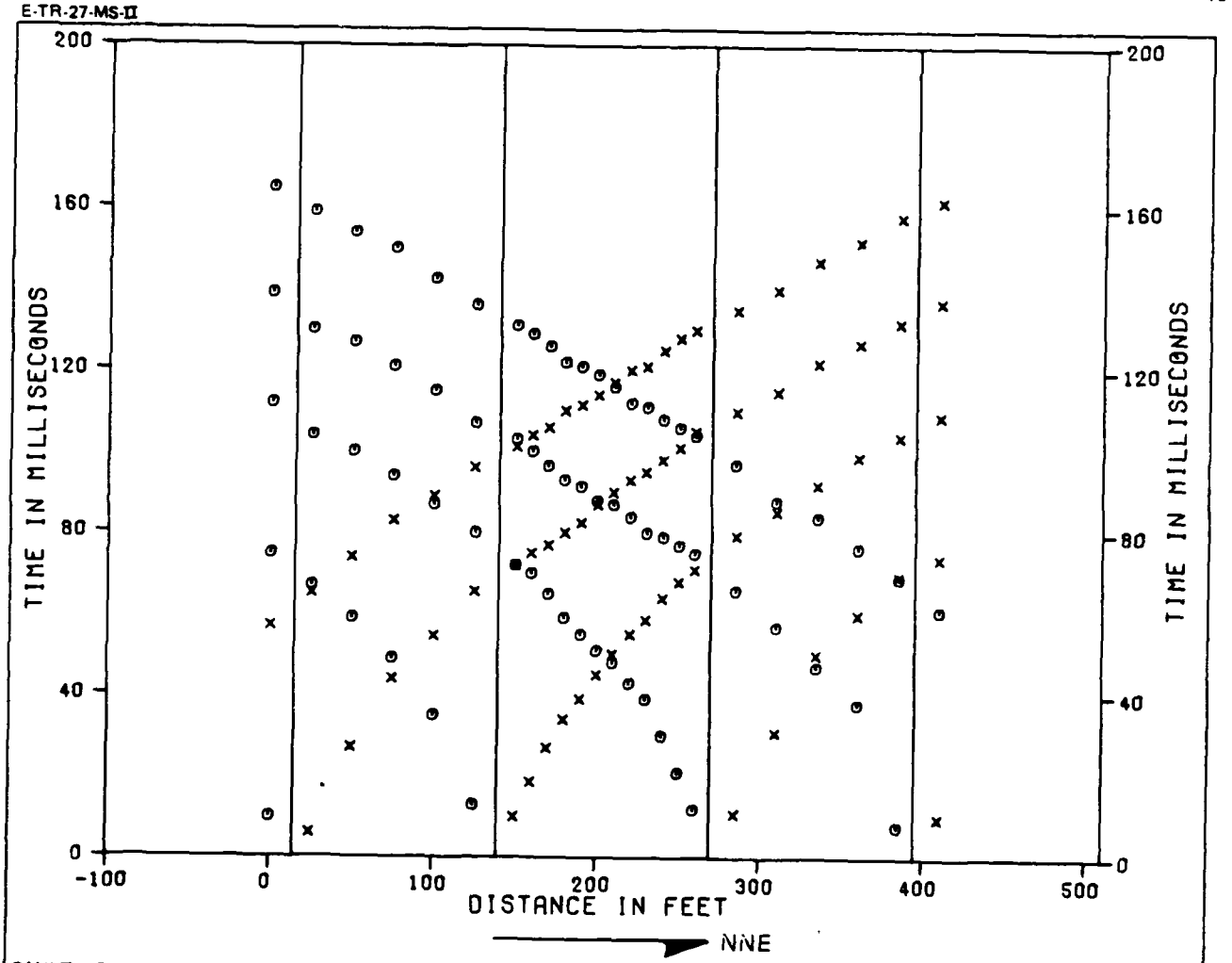
SEISMIC REFRACTION LINE MS-S-1
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-4-1



0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

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SEISMIC REFRACTION LINE MS-S-2
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

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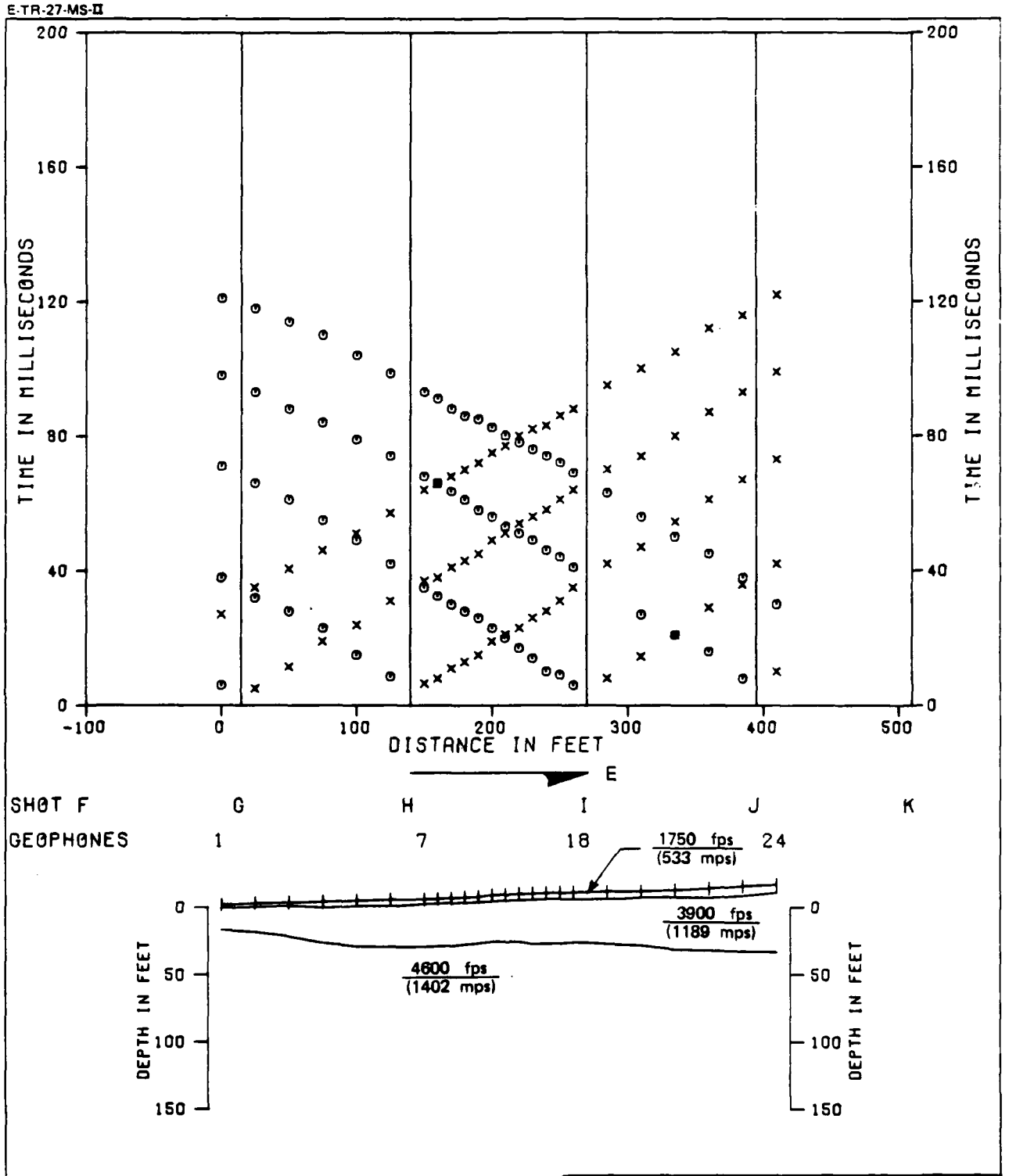
FIGURE II-4-2

E-TR-27-MS-II



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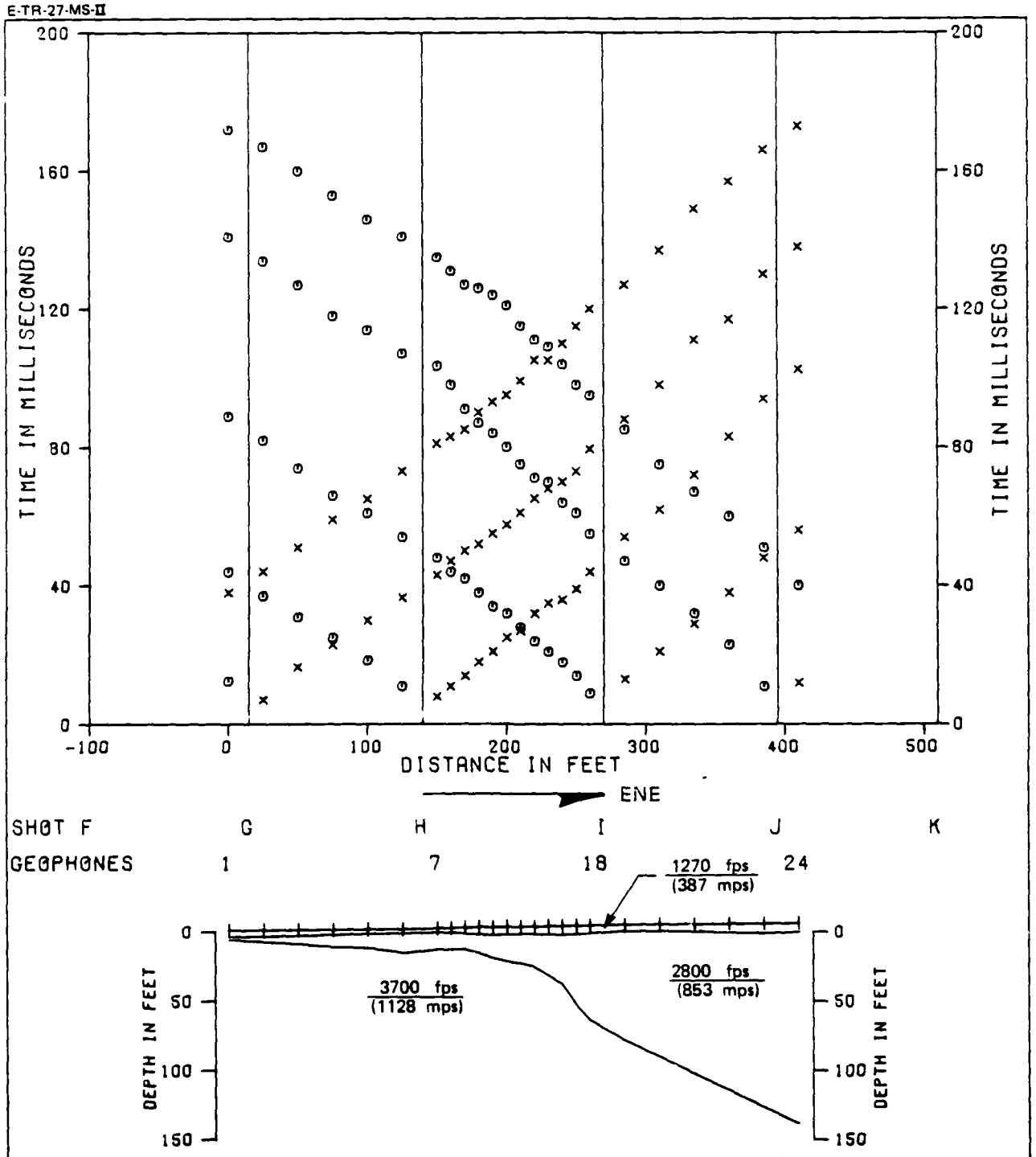
SEISMIC REFRACTION LINE MS-S-3
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-4-3

E-TR-27-MS-II



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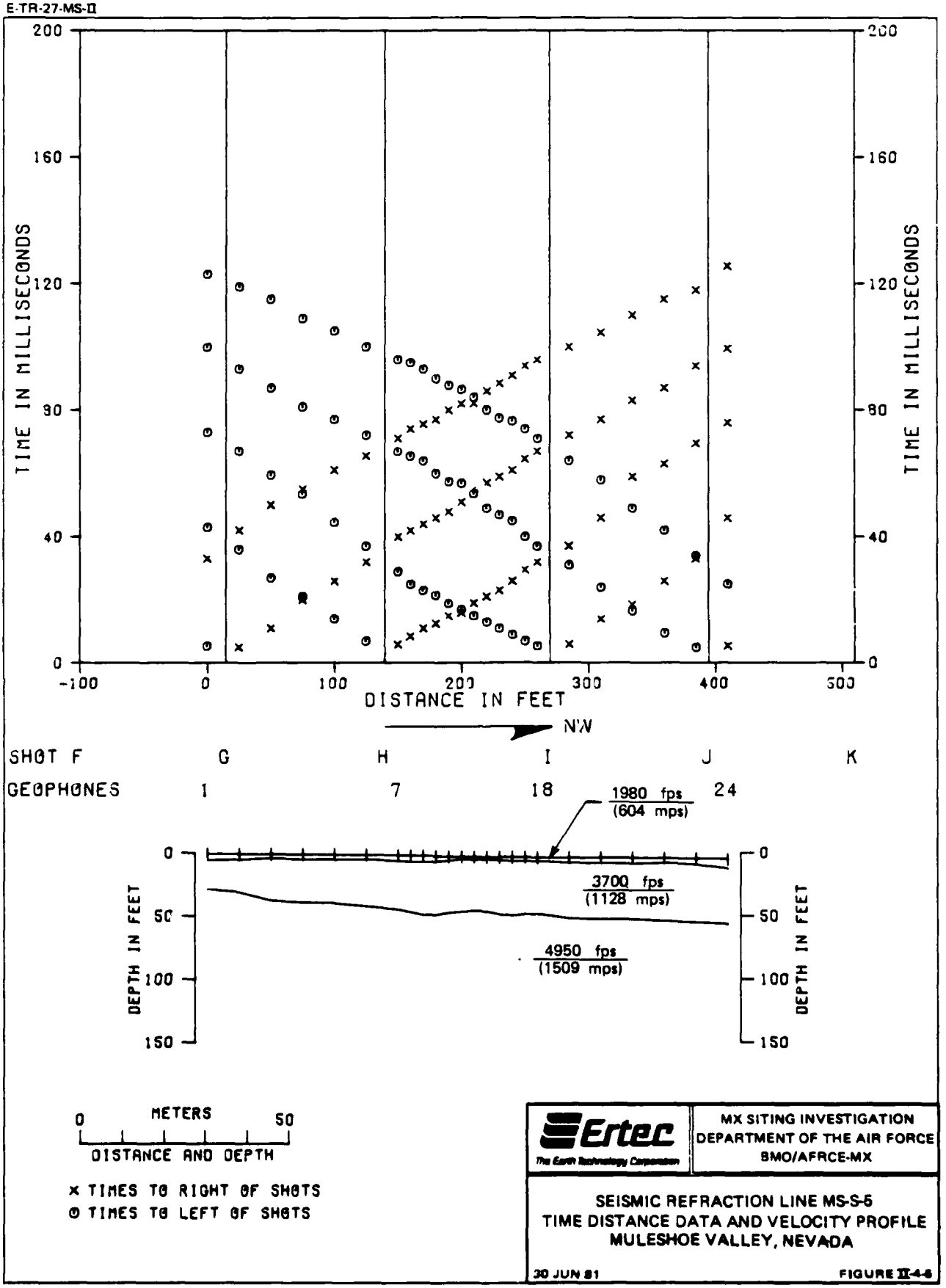
SEISMIC REFRACTION LINE MS-S-4
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-4-4

E-TR-27-MS-II


200
160
120
90
40
0
TIME IN MILLISECONDS
-100
0
100
200
300
400
500
DISTANCE IN FEET
NW
SHOT F
G
H
I
J
K
GEOPHONES
1
7
18
24
1980 fps
(604 mps)
3700 fps
(1128 mps)
4950 fps
(1509 mps)
0
50
100
150
DEPTH IN FEET
0
METERS
50
DISTANCE AND DEPTH
× TIMES TO RIGHT OF SHOTS
⊙ TIMES TO LEFT OF SHOTS
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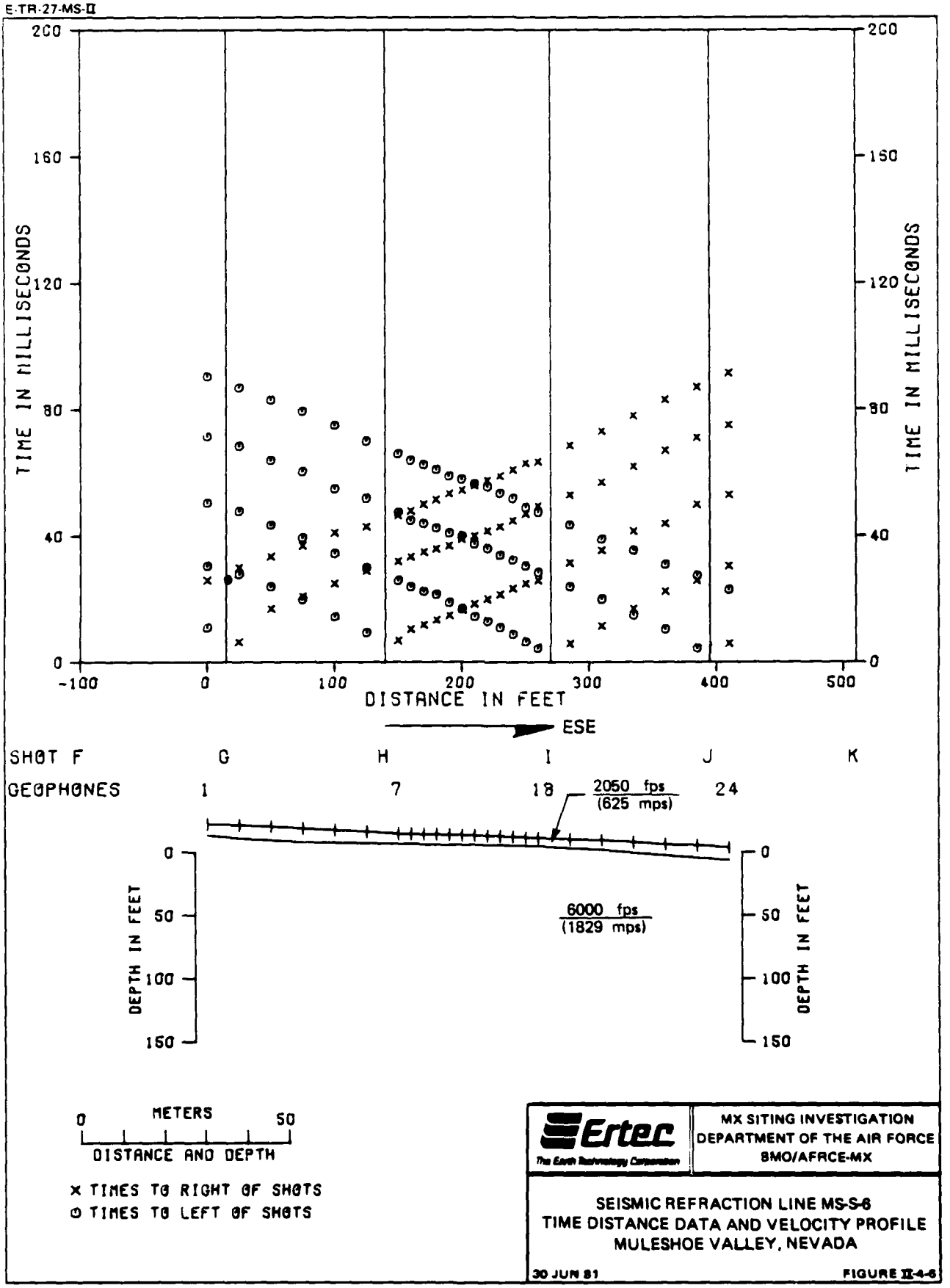
SEISMIC REFRACTION LINE MS-S-5
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA
30 JUN 81
FIGURE II-4-6

E-TR-27-MS-II



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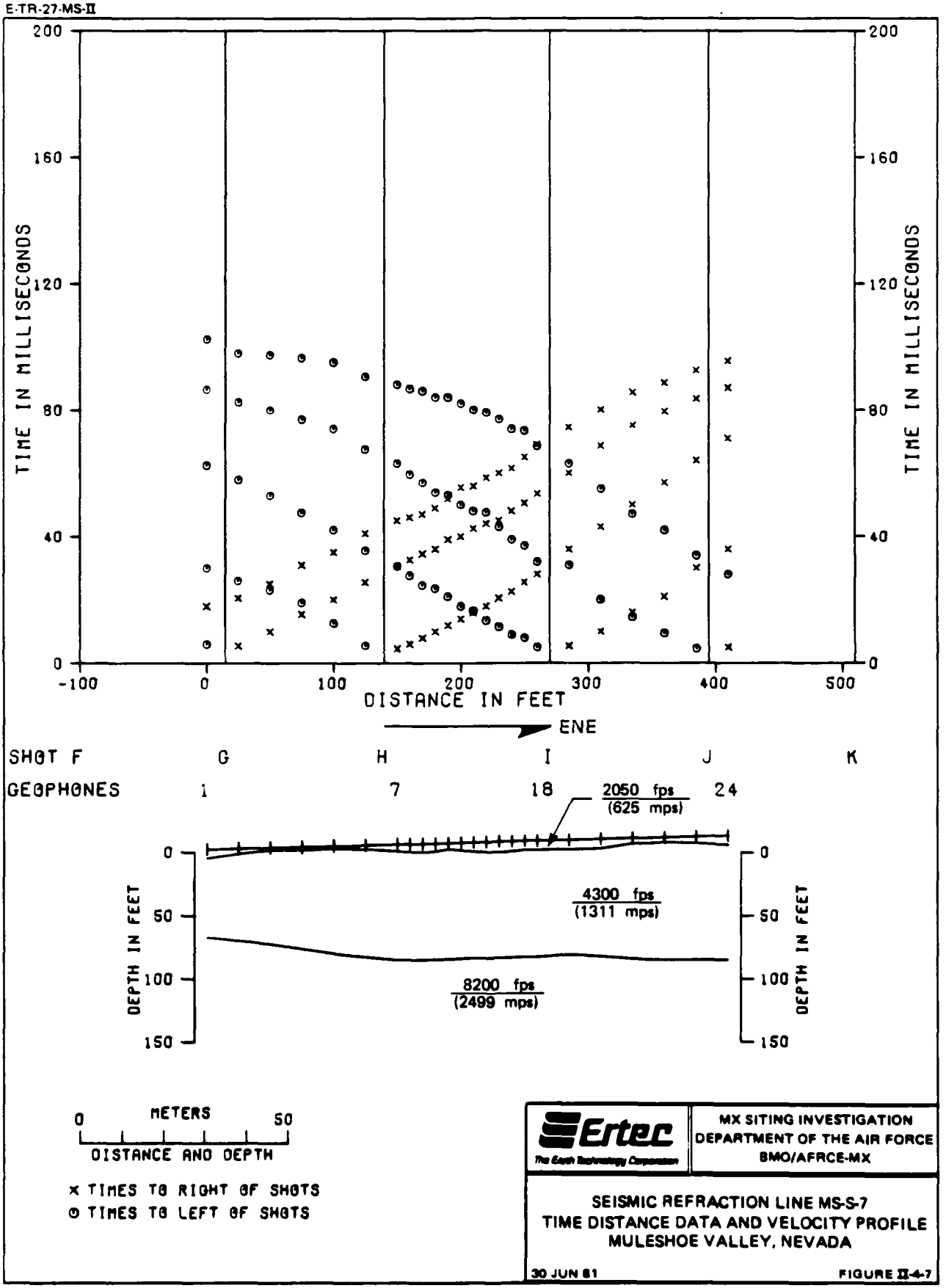
SEISMIC REFRACTION LINE MS-S-6
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-4-6

E-TR-27-MS-II



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SEISMIC REFRACTION LINE MS-S-7
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

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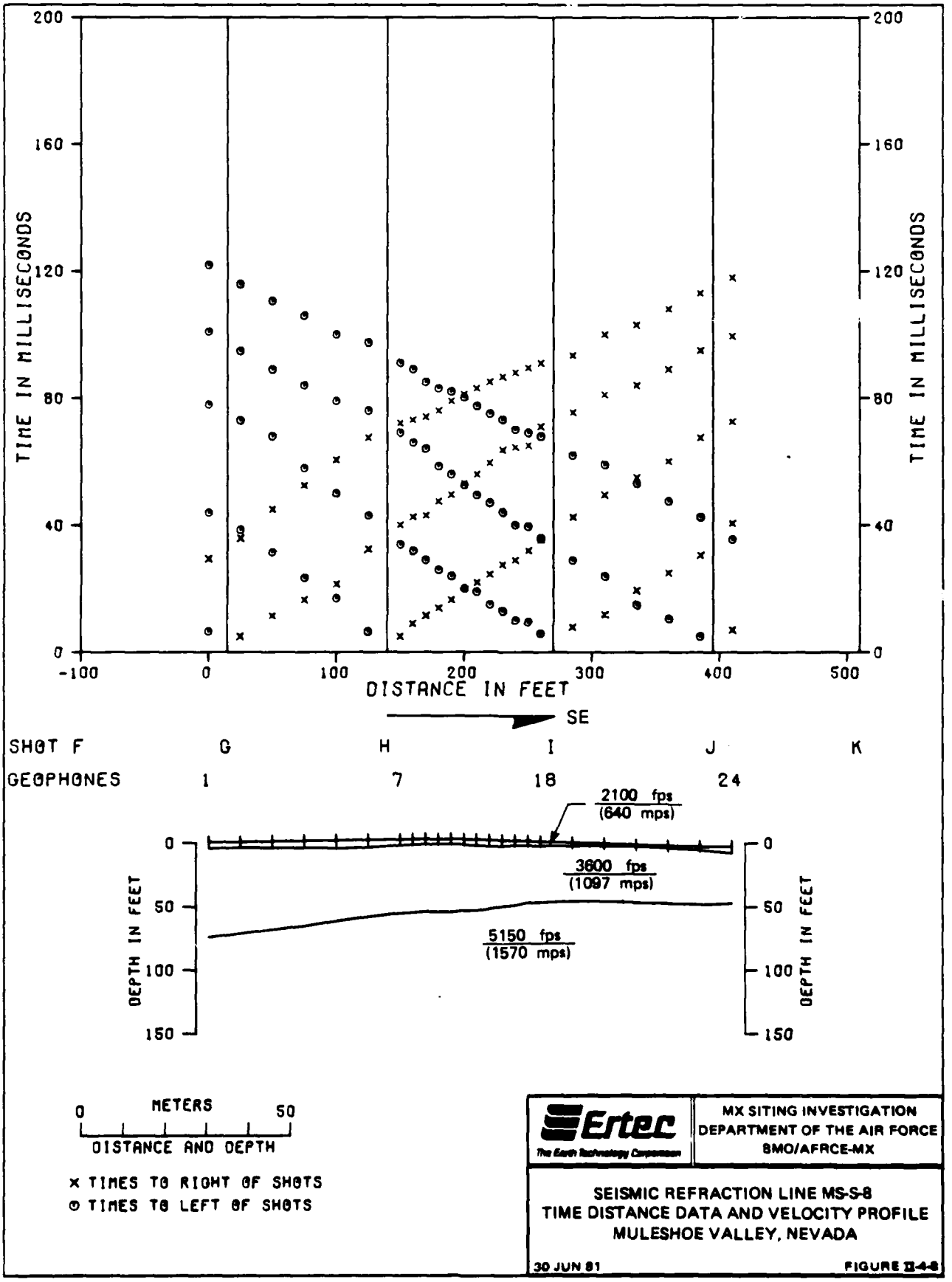
FIGURE II-4-7

E-TR-27-MS-II



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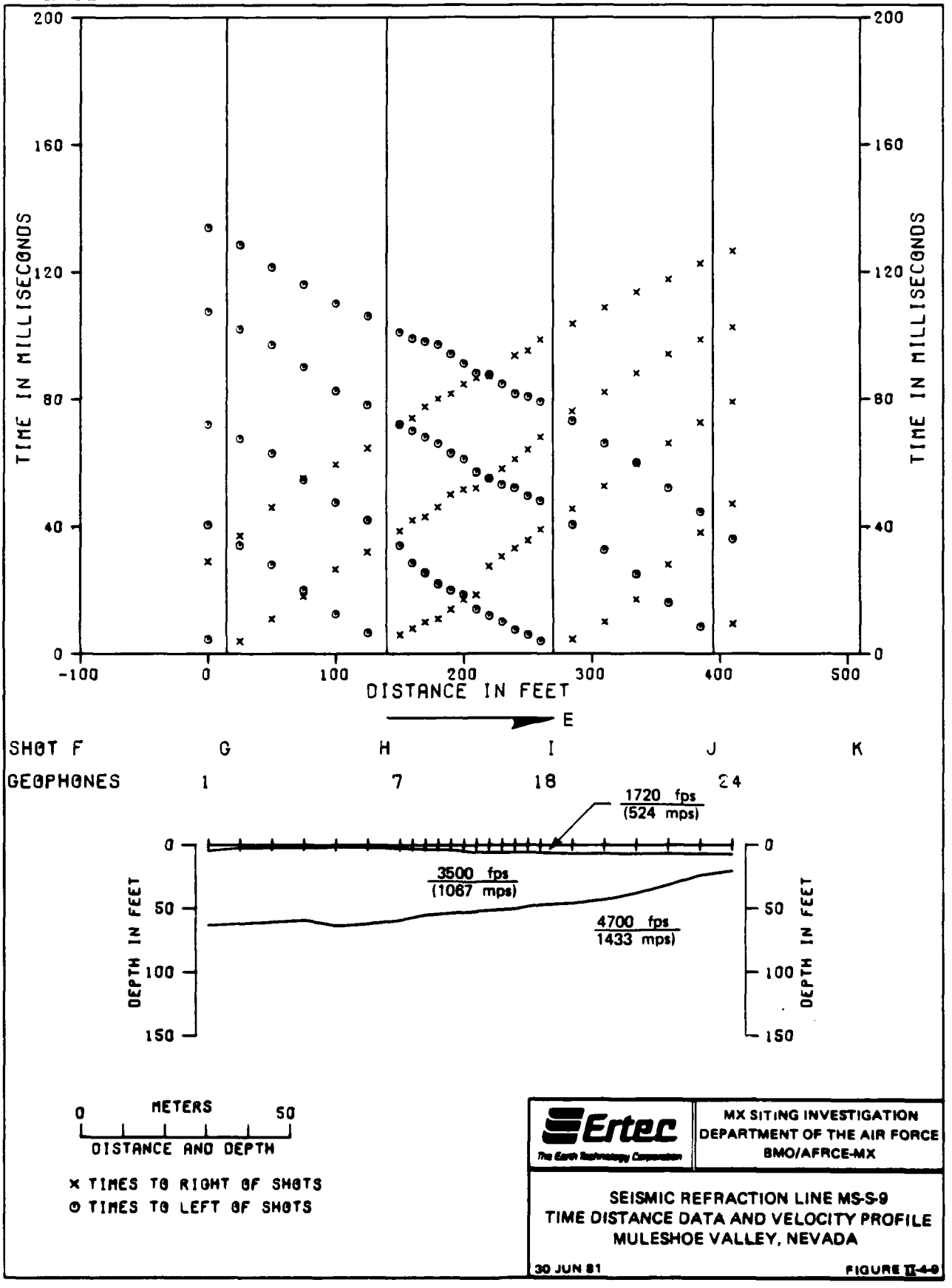
SEISMIC REFRACTION LINE MS-S-8
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-4-8

E-TR-27-MS-II


200
160
120
80
40
0
TIME IN MILLISECONDS
-100
0
100
200
300
400
500
DISTANCE IN FEET
E
SHOT F
G
H
I
J
K
GEOPHONES
1
7
18
24
1720 fps
(524 mps)
3500 fps
(1067 mps)
4700 fps
1433 mps)
DEPTH IN FEET
50
100
150
METERS
DISTANCE AND DEPTH
× TIMES TO RIGHT OF SHOTS
⊙ TIMES TO LEFT OF SHOTS
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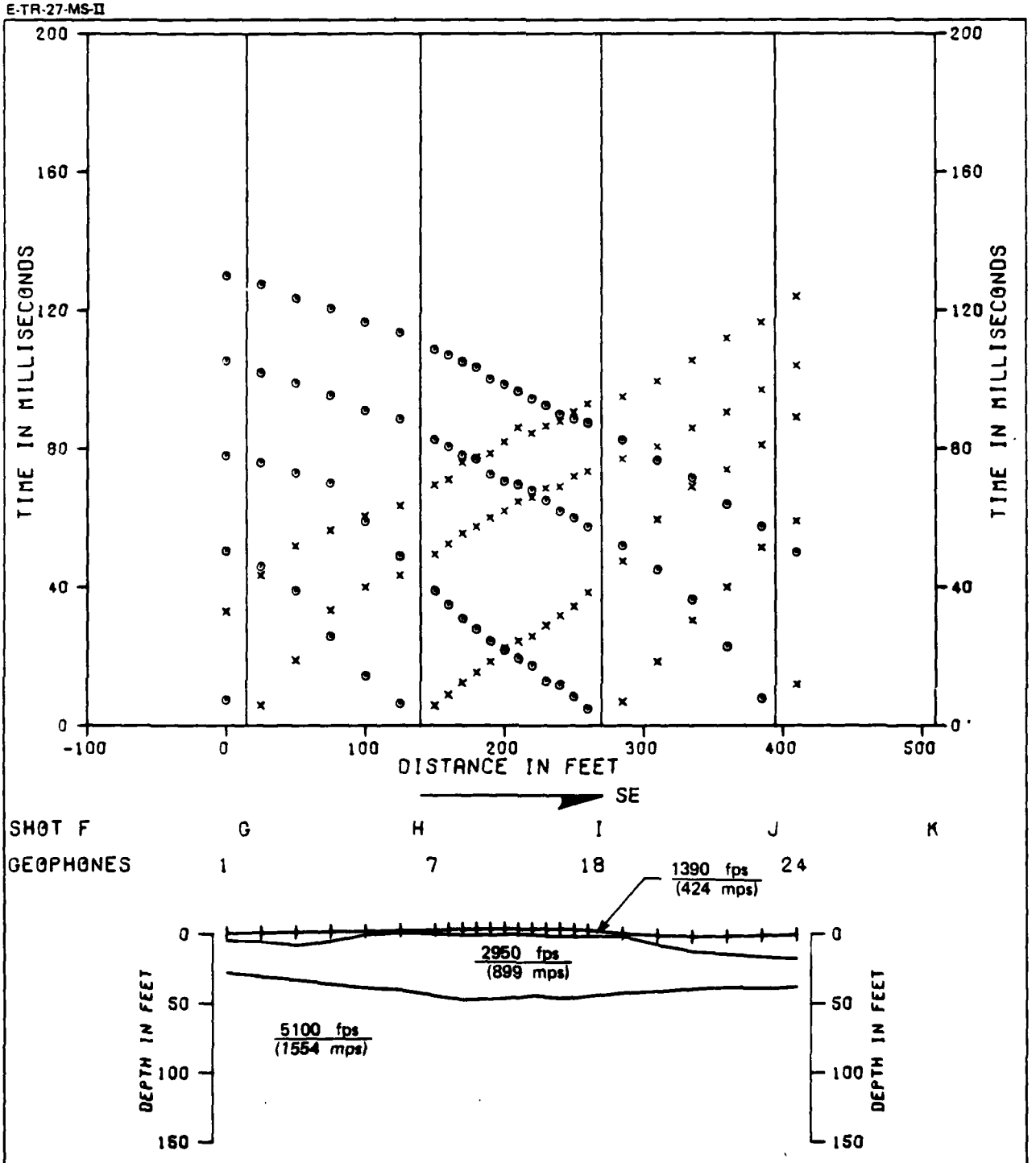
SEISMIC REFRACTION LINE MS-S-9
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA
30 JUN 81
FIGURE II-4-9

E-TR-27-MS-II



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SEISMIC REFRACTION LINE MS-S-10
TIME DISTANCE DATA AND VELOCITY PROFILE
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-4-19

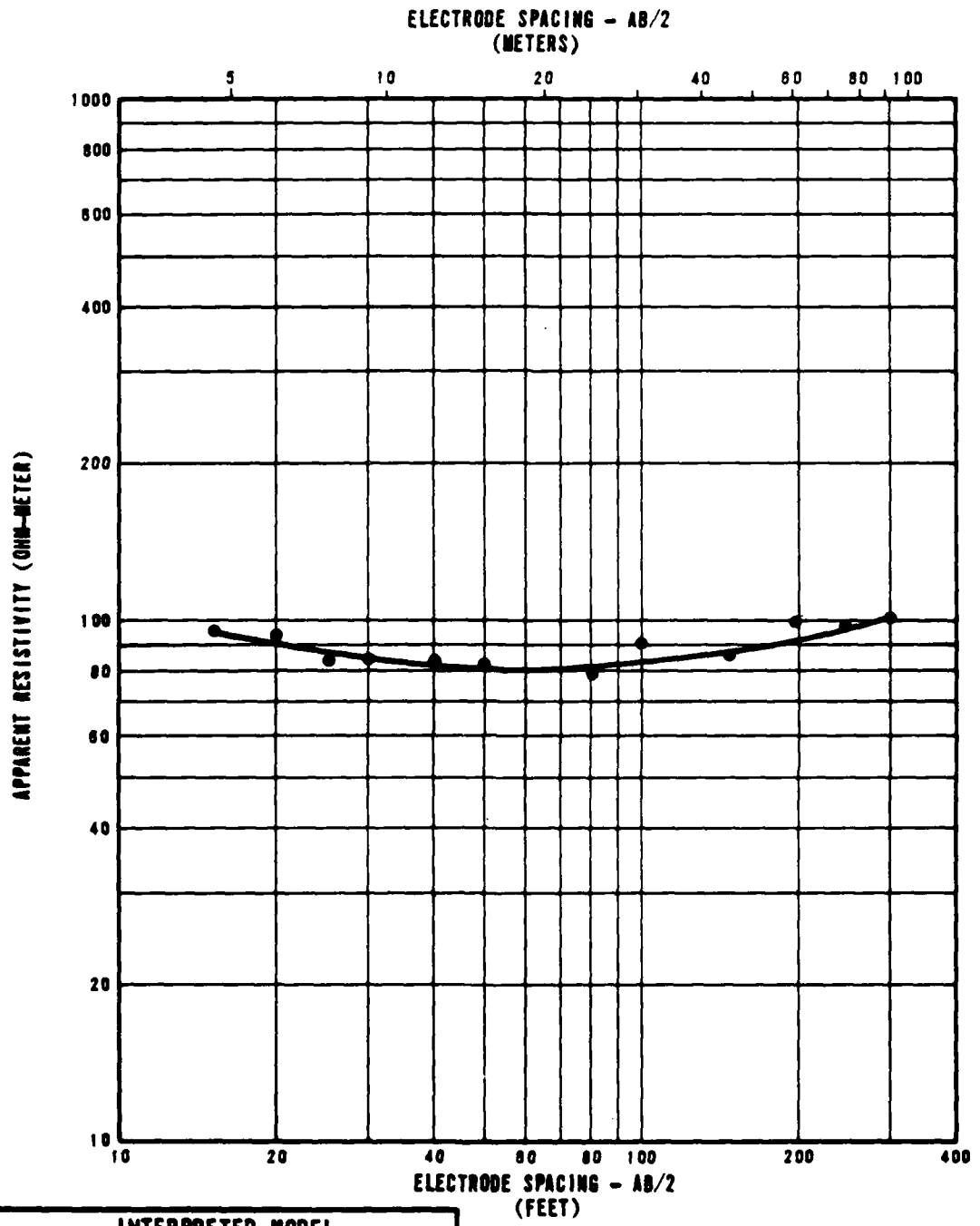
5.0 ELECTRICAL RESISTIVITY DATA

Explanation: Each figure in this section presents the data obtained from a resistivity sounding and a tabulated model of resistivity layers that would produce a curve similar to the observed curve.

The upper portion of the figures is a graph in which measured apparent resistivity values in ohm-meters are plotted versus one-half the distance between the current electrodes.

The interpreted model tabulated at the bottom of the page shows a combination of true resistivity layers and thicknesses obtained by matching theoretical curves to the field curve.

Note: There was no resistivity sounding at location MS-SR-2 because of electrical interference from a grounded fence.



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	100
12	4	75
70	21	110

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RESISTIVITY SOUNDING MS-R-1
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

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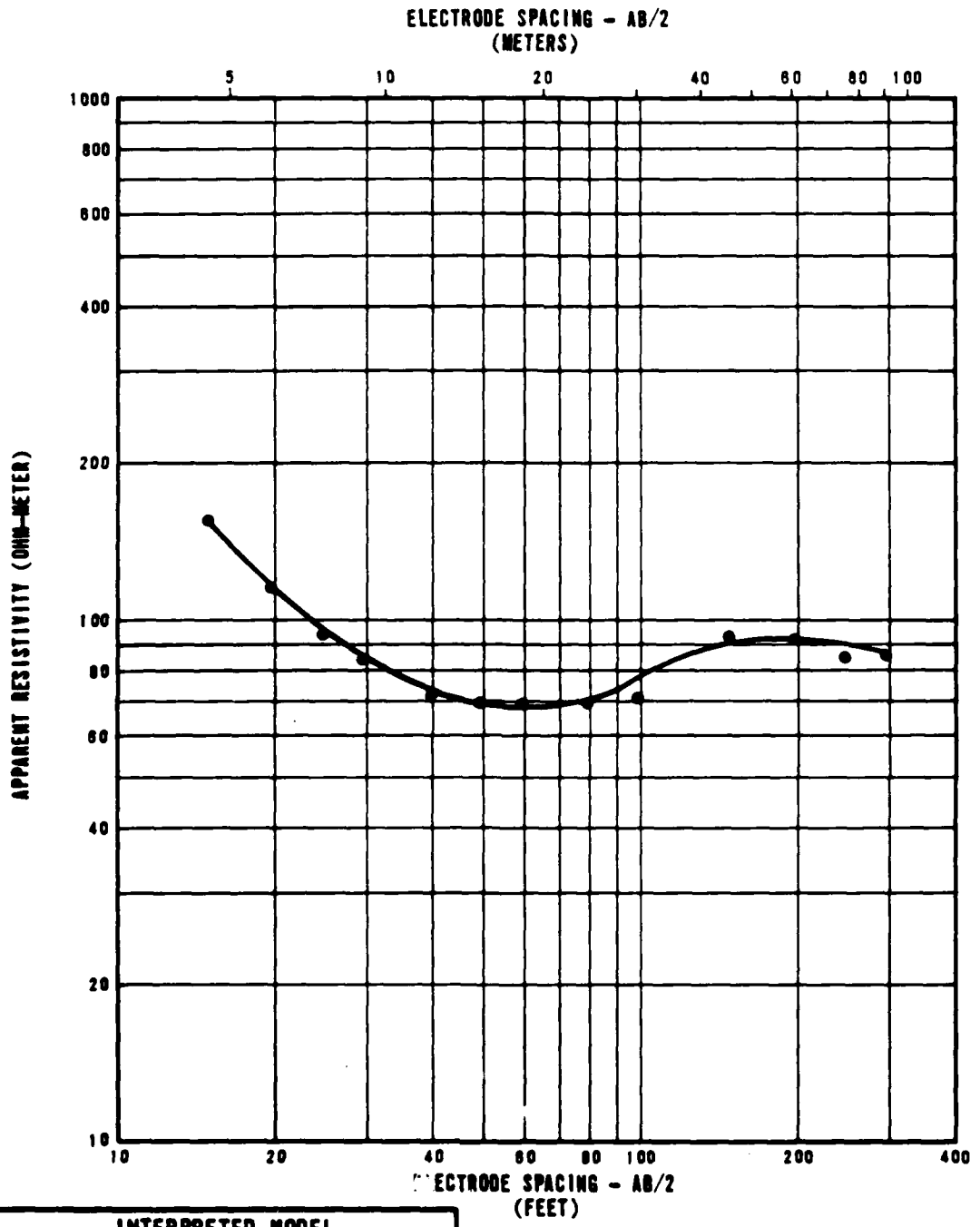
FIGURE II-6-1



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	250
7	2	65
55	17	110
176	54	60

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RESISTIVITY SOUNDING MS-R-3
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

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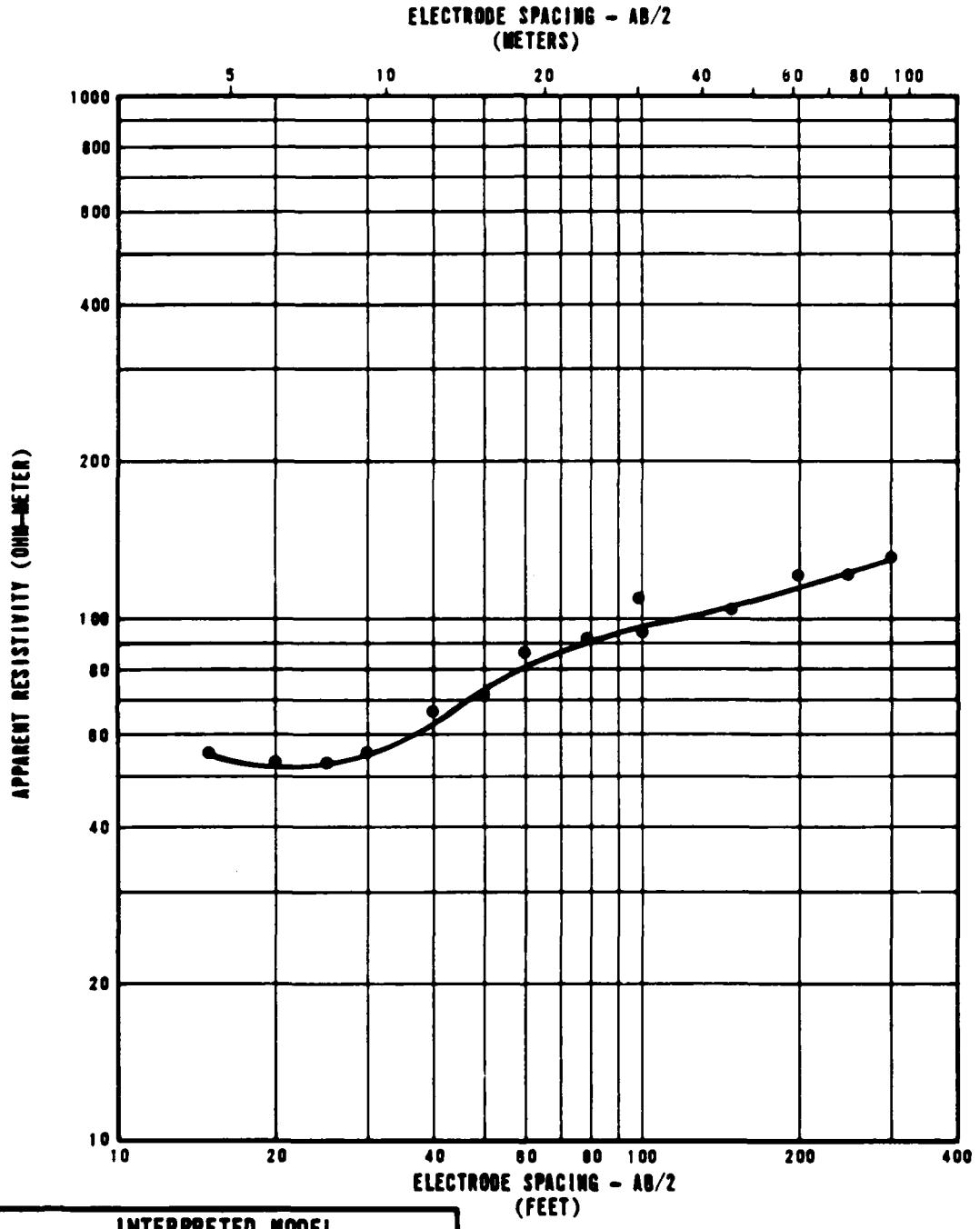
FIGURE II-6-2



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	50
25	8	280
32	10	110
163	50	250

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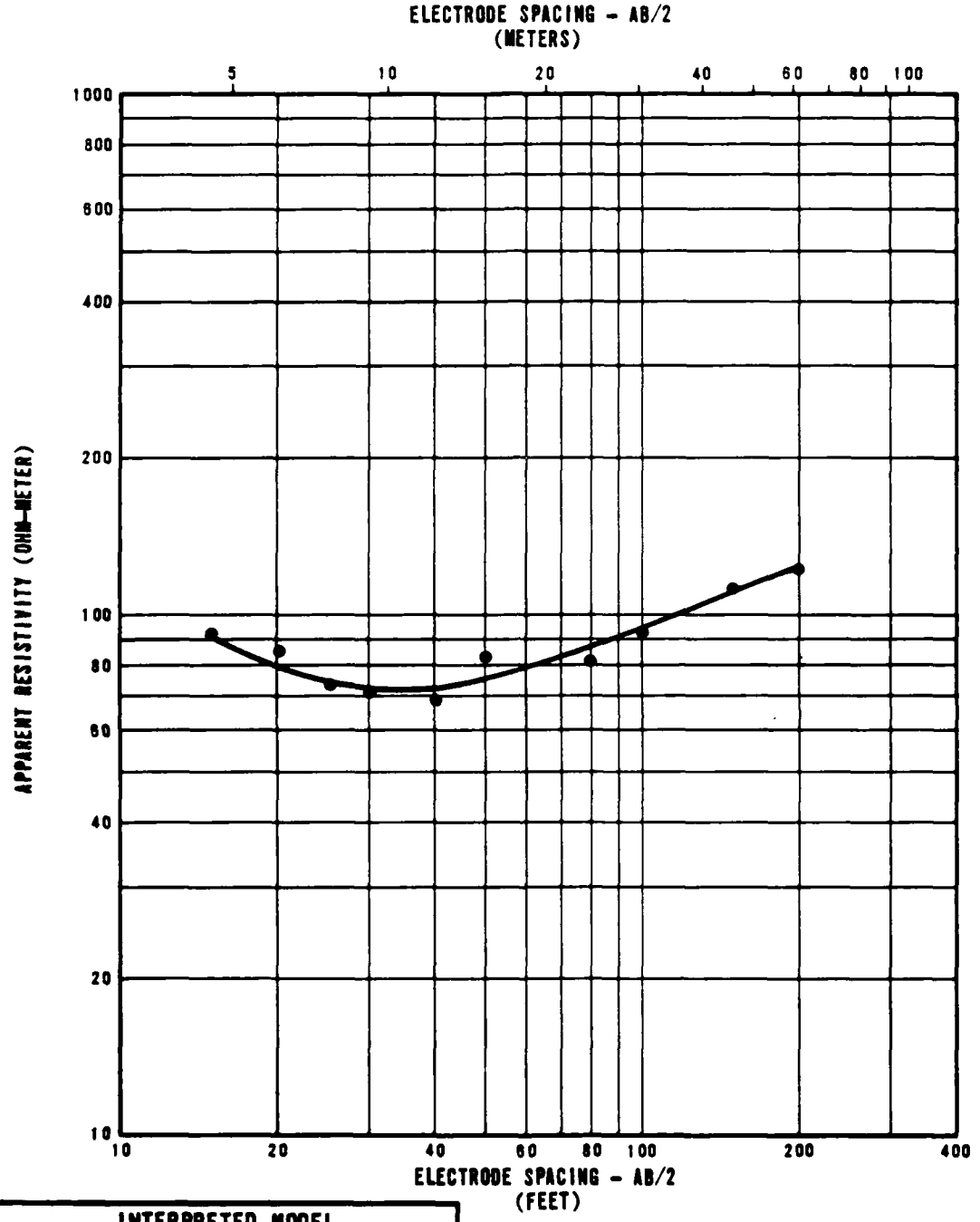
RESISTIVITY SOUNDING MS-R-4
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-6-3

USAF-15



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	120
5	2	80
50	15	150

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RESISTIVITY SOUNDING MS-R-6
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

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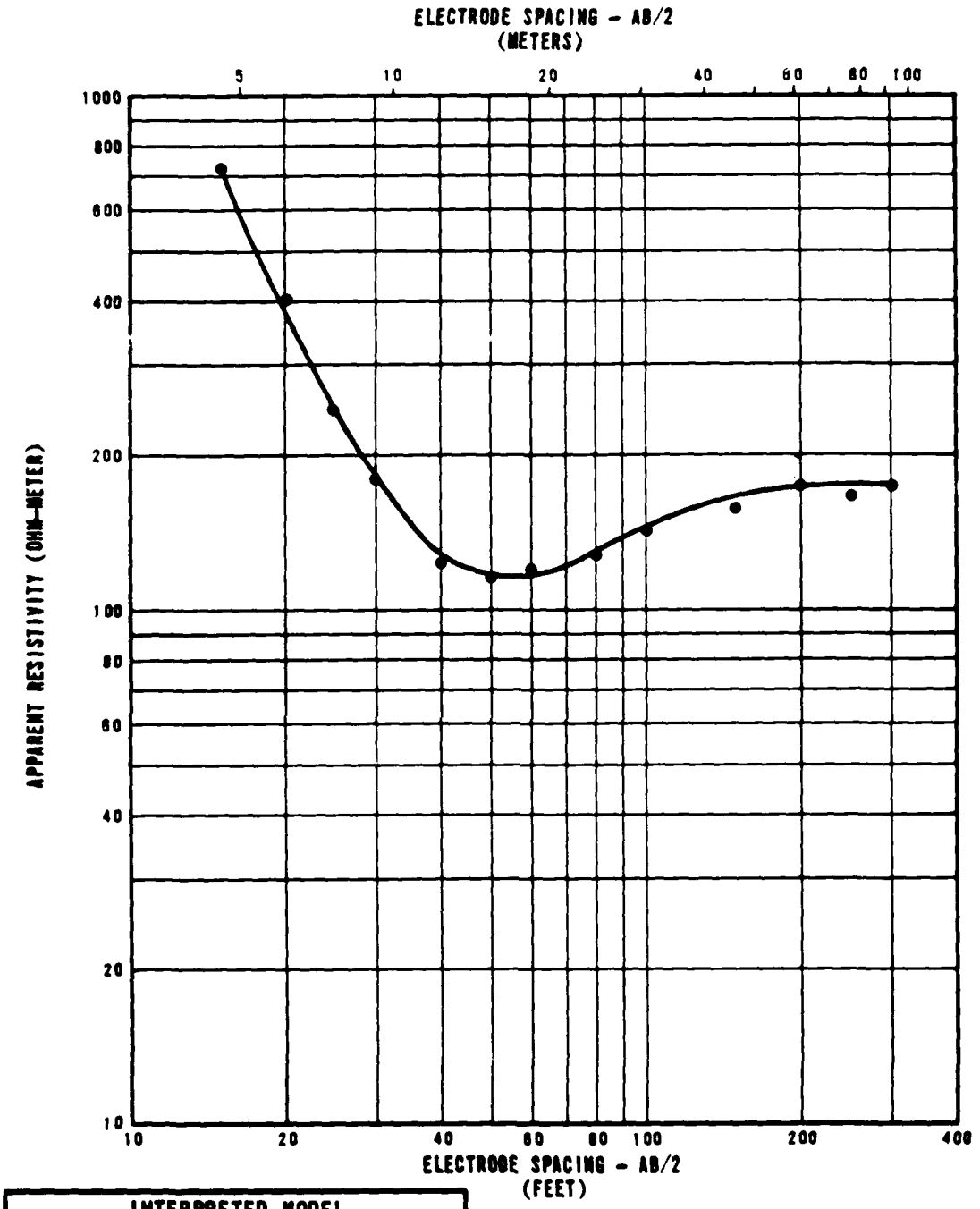
FIGURE II-6-4



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	710
10	3	240
14	4	190

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RESISTIVITY SOUNDING MS-R-6
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

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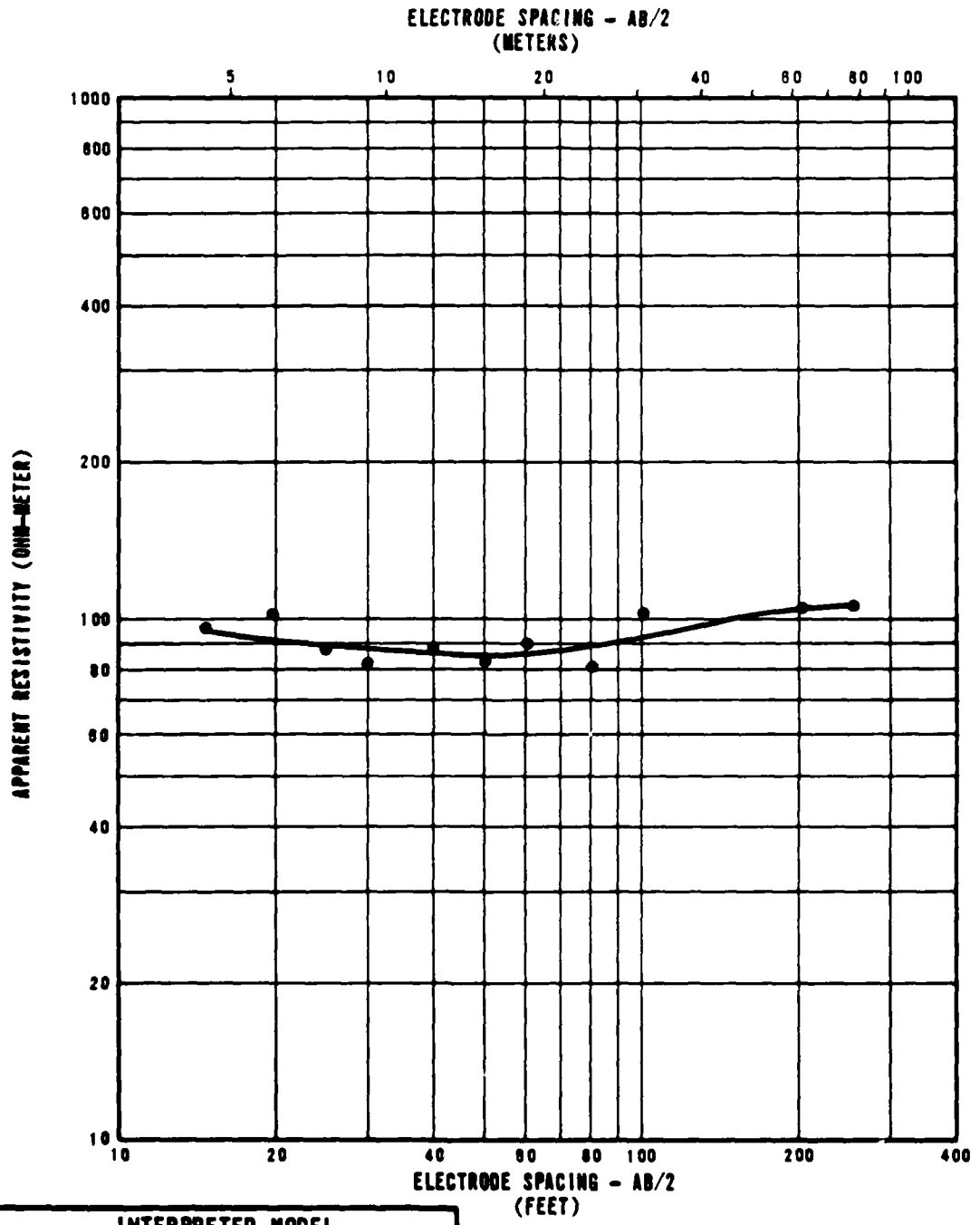
FIGURE II-6-6

USAF-15



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	95
20	6	75
39	12	90
62	19	130

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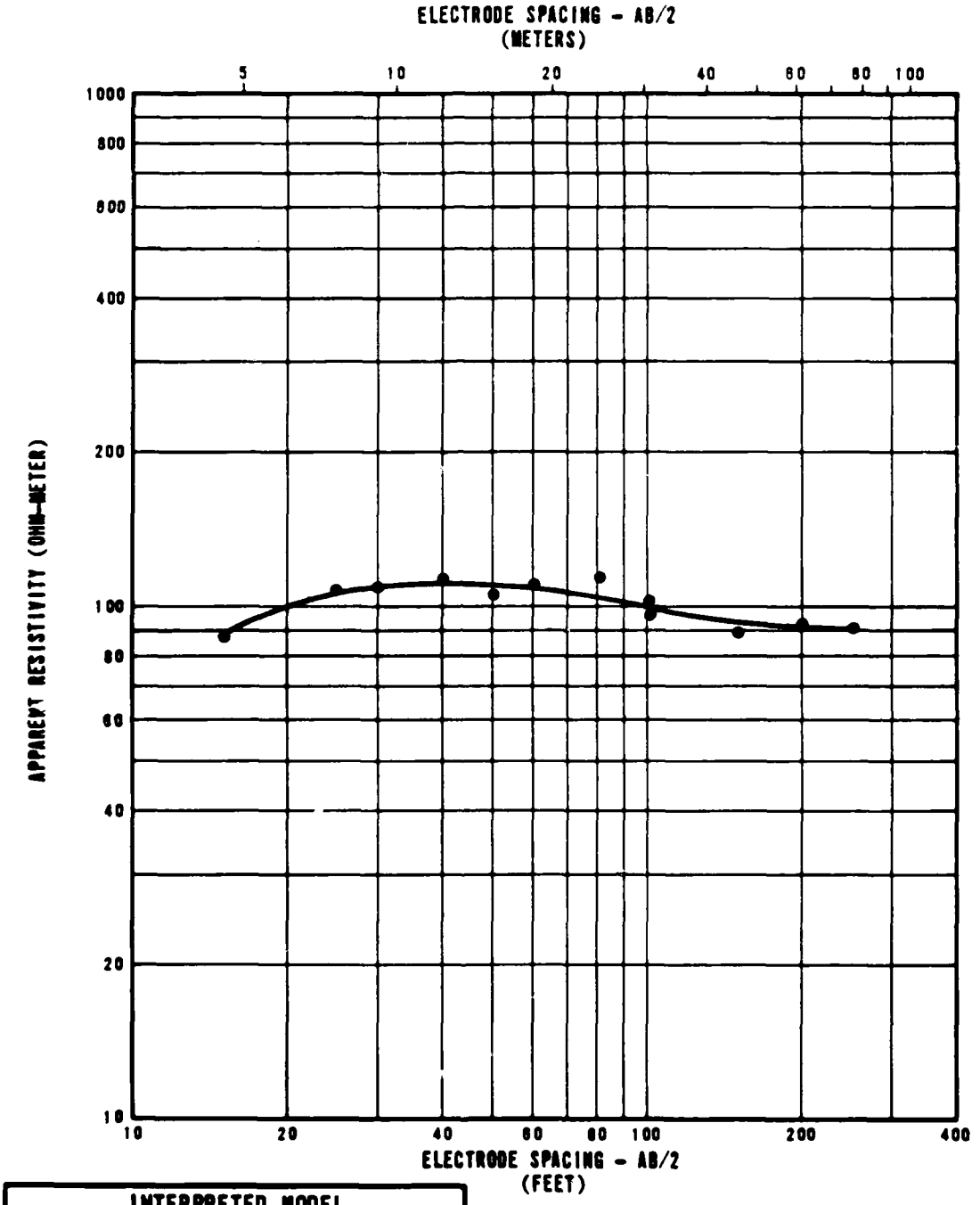
RESISTIVITY SOUNDING MS-R-7
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-5-6

USAF-18



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	65
5	2	130
29	9	80
90	27	110

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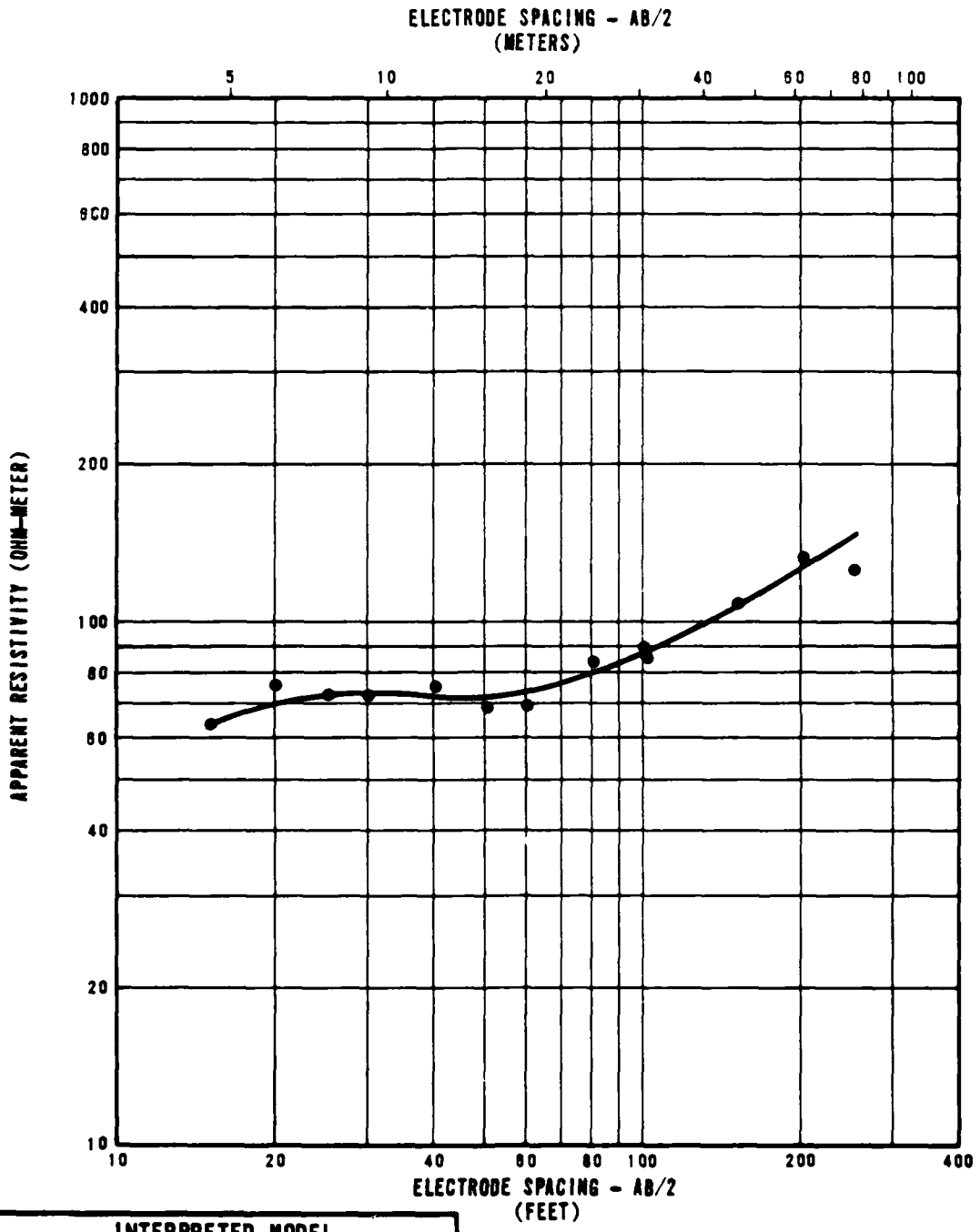
RESISTIVITY SOUNDING MS-R-8
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-6-7

USAF-15



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	50
5	2	80
26	8	55
60	18	250

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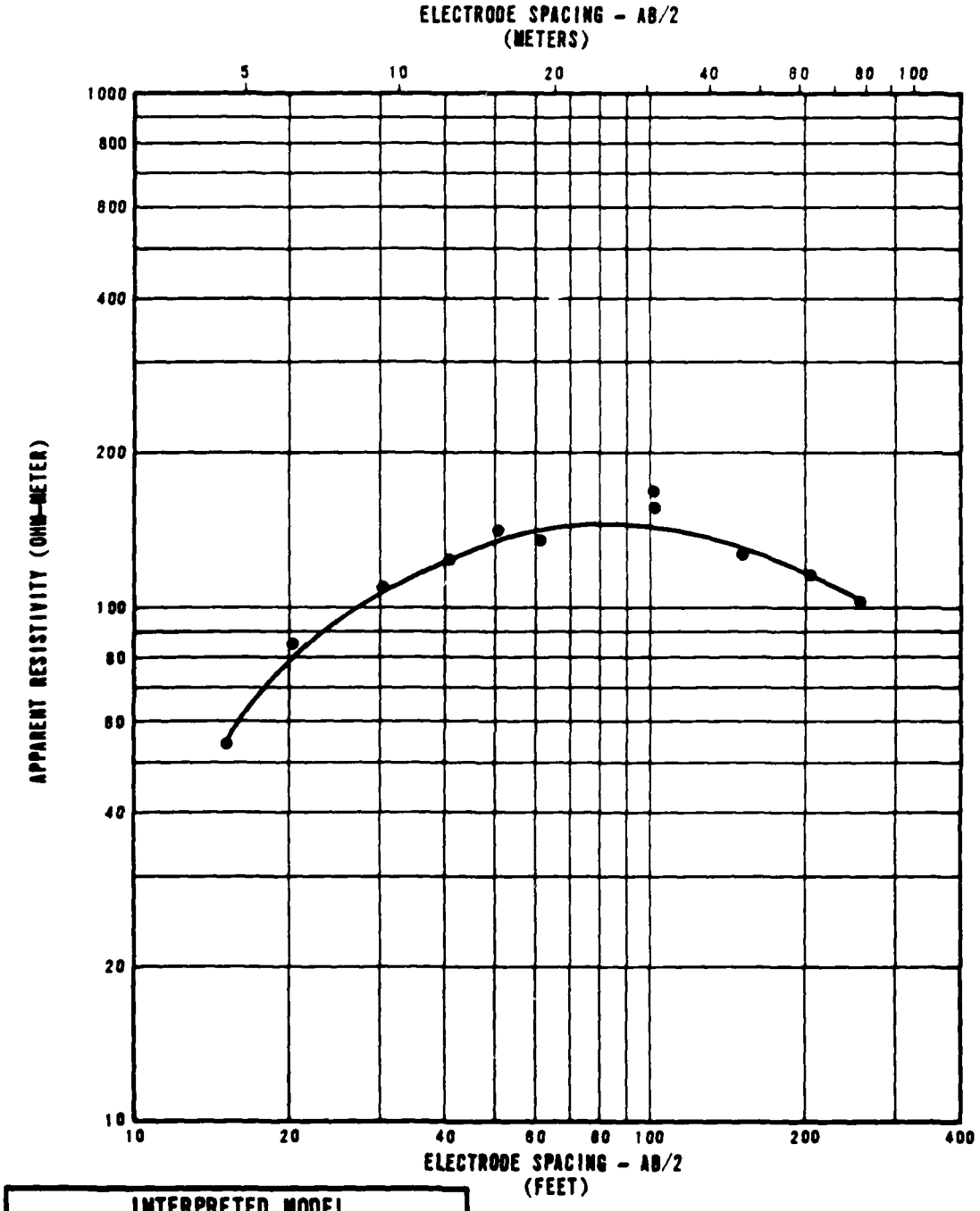
RESISTIVITY SOUNDING MS-R-9
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-5-9

USAF-18



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	30
5	2	140
10	3	240
38	12	150
80	24	70

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RESISTIVITY SOUNDING MS-R-10
SOUNDING CURVE AND INTERPRETATION
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-6-9

USAF-18

6.0 BORING LOGS

Explanation: All data from borings, trenches and test pits are presented on standard Ertec Western logs in Sections 6.0 and 7.0. Explanations of the column headings on the logs are as follows:

A. Designations - Borings and trenches are identified as follows:

MS-B-1
MS - abbreviation for the valley (e.g., MS Muleshoe)
B - abbreviation for activity (e.g., B-boring, T-trench, P-test pit)
1 - number of activity

B. Sample Type - Different sampling techniques were used and the symbols are explained at the bottom of the boring logs. For details of sampling techniques, see Section A5.0 of Appendix in Volume I (E-TR-27-MS-I). Horizontal lines, to scale, indicate the depth where sampling was attempted.

C. Percent Recovery - The numbers shown represent the ratio (in percent) of the soil sample recovered in the sampler to the full penetration of the sampler.

D. N Value - Corresponds to standard penetration resistance, which is number of blows required to drive a standard split-spoon sampler for the second and third of three 6-inch (15-cm) increments with a 140-pound (63.5 kg) hammer falling 30 inches (76 cm) (ASTM D 1586-67).

E. Depth - Corresponds to depth below ground surface in meters and feet.

F. Lithology - Graphic representation of the soil and rock types.

G. USCS - Unified Soil Classification System symbols (see Table II-6-1 for complete details).

H. Soil Description - Except in cases where samples were classified based on laboratory test data, the descriptions are based on visual classification. The procedures outlined in ASTM D 2487-69, Classification of Soils for Engineering Purposes, and D 2488-69, Description of Soils (Visual-Manual Procedure), were followed. A solid line across the column indicates change in strata at the depth shown.

Definitions of some of the terms and criteria to describe soils and conditions encountered during the exploration follow.

Gradation : A coarse-grained soil is well graded if it has a wide range in grain size and substantial amounts of most intermediate particle sizes.

Poorly graded indicates that the soil consists predominantly of one size (uniformly graded) or has a wide range of sizes with some intermediate sizes obviously missing (gap-graded).

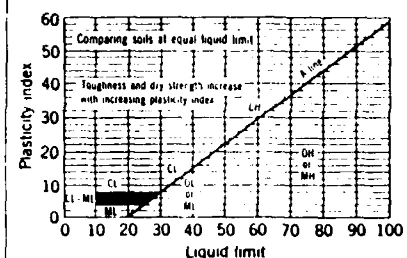
Moisture :

Dry	- no feel of moisture - dry like powder
Slightly Moist	- much less than optimum moisture
Moist	- near optimum moisture for soil - provides apparent cohesion
Very Moist	- much greater than optimum moisture
Wet	- at or near saturation

Consistency: Consistency descriptions of coarse-grained soils (GW, GP, GM, GC, SW, SP, SM, SC) follow.

Major Divisions			Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights)	Group Symbols [a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils More than half of material is *larger* than No. 200 sieve size[b] (The No. 200 sieve size is about the smallest particle visible to naked eye)	Gravels More than half of coarse fraction is larger than No. 4 sieve size (For visual classification, the ¼ in. size may be used as equivalent to the No. 4 sieve size)	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel, maximum size, angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses	Use grain size curve in identifying the fractions as given under field identification. Determine percentages of gravel and sand from grain size curve. *Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse grained soils are classified as follows:* Less than 5%: *GW, GP, SW, SP*; More than 12%: *GM, GC, SM, SC*; 5% to 12%: *Borderline cases requiring use of dual symbols*. $C_U = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing	*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for *GW*
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)	*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures		Atterberg limits below "A" line, or *PI* less than 4 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)	*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures	For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics	Atterberg limits above "A" line, with *PI* greater than 7
	Sands More than half of coarse fraction is smaller than No. 4 sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes	*SW*	Well graded sands, gravelly sands, little or no fines	Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles ½-in. maximum size; rounded and subangular sand grains coarse to fine; about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; *(SM)*	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing	*SP*	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for *SW*
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)	*SM*	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line or *PI* less than 5 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)	*SC*	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits below "A" line with *PI* greater than 7

Major Divisions		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)	Group Symbols [a]	Typical Names	Information Required for Describing Soils
Fine-grained soils More than half of material is *smaller* than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to naked eye)	Identification Procedures on Fraction Smaller than No. 40 Sieve Size						
	Silts and clays liquid limit less than 50	None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses
		Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions
		Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity	
	Silts and clays liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; *(ML)*
		High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity	
Highly Organic Soils		Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils	



Plasticity chart for laboratory classification of fine grained soils

From Wagner, 1957.
[a] *Boundary classifications.* Soils possessing characteristics of two groups are designated by combinations of group symbols. For example *GW-GC*, well graded gravel-sand mixture with clay binder.
[b] All sieve sizes on this chart are U.S. standard.

Field Identification Procedure for Fine Grained Soils or Fractions

These procedures are to be performed on the minus No. 40 sieve size particles, approximately 1/64 in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (Reaction to shaking)

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics)

After removing particles larger than No. 40 sieve size, mould a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit)

After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size, is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eight inch in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

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UNIFIED SOIL CLASSIFICATION SYSTEM

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TABLE II-6-1

Consistency	N Value (ASTM D 1586-67)
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Consistency descriptions of fine-grained soils (ML, CL, MH, CH) are as follows:

Consistency	Shear Strength (ksf)	Shear Strength (kn/m^2)	Field Guide
Very Soft	0.25	12	Sample with height equal to twice the diameter, sags under own weight
Soft	0.25-0.50	12 - 24	Can be squeezed between thumb and forefinger
Firm	0.50-1.00	24-48	Can be molded easily with fingers
Stiff	1.00-2.00	48-96	Can be imprinted with slight pressure from fingers
Very Stiff	2.00-4.00	96-192	Can be imprinted with considerable pressure from fingers
Hard	over 4.00	over 192	Cannot be imprinted by fingers

Grain Shape:

Angular - particles have sharp edges and relatively plane sides with unpolished surfaces.

Subangular - particles are similar to angular but have somewhat rounded edges.

Subrounded - particles exhibit nearly plane sides but have well-rounded corners and edges.

Rounded - particles have smoothly curved sides and no edges.

Calcareous : Containing calcium carbonate; presence of calcium carbonate is commonly identified on the basis of reaction with dilute hydrochloric acid.

Caliche : Soils cemented by calcium carbonate and/or other soluble minerals by upward-moving solutions.

Degree of Cementation: (Stages of development of caliche profile)

Stage	Gravelly Soils	Nongravelly Soils
I	Thin, discontinuous pebble coatings	Few filaments or faint coatings
II	Continuous pebble coatings, some interpebble fillings	Few to abundant nodules, flakes, filaments
III	Many interpebble fillings	Many nodules and internodular fillings
IV	Laminar horizon overlying plugged horizon	Increasing carbonate impregnation

Secondary Material : Example - Sand with trace to some silt

Trace - 5-12% (by dry weight)
Little - 13-20% (by dry weight)
Some - >20% (by dry weight)

Plasticity : Plasticity index is the range of water content, expressed as a percentage of the weight of the oven-dried soil, through which the soil is plastic. It is defined as the liquid limit minus the plastic limit. Descriptive ranges used on the logs include:

Nonplastic (PI, 0 - 4)
Slightly Plastic (PI, 4 - 15)
Medium Plastic (PI, 15 - 30)
Highly Plastic (PI, >30)

Cobbles and Boulders : A cobble is a rock fragment, usually rounded by weathering or abrasion, with an average diameter ranging between 3 and 12 inches (8 and 30 cm).

A boulder is a rock fragment, usually rounded by weathering or abrasion, with an average diameter of 12 inches (30 cm) or more.

I. Remarks - This column was provided on boring and trench logs for comments regarding drilling difficulty, number and size of cobbles or boulders encountered, loss of drilling fluid in the boring, trench wall stability, and other conditions encountered during drilling and excavations.

J. Dry Density and Moisture Content - The boring logs include a graphical display of laboratory test results for dry density (ASTM D 2937-71) in pounds per cubic foot and kilograms per cubic meter and moisture content (ASTM D 2216-71) in percent from representative samples taken during drilling. The symbols are explained at the bottom of the boring logs.

K. Sieve Analysis - The numbers represent the percentage by dry weight (ASTM D 422-63) of each of the following soil components:

GR - Gravel, rock particles that will pass a 3-inch (76-mm) sieve and are retained on No. 4 (4.75 mm) sieve.

SA - Sand, soil particles passing No. 4 sieve and retained on No. 200 (0.075 mm) sieve.

FI - Fines, silt or clay soil particles passing No. 200 sieve.

L. Atterberg Limits (LL and PI) -

LL - Liquid Limit, the water content corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

M. Miscellaneous Information -

Elevations - indicated elevations on the logs are estimated from topographic maps of the study area, within an accuracy of half the contour interval.

Surficial Geologic Unit - indicates the surficial geologic unit in which the activity is located.

Date Drilled - indicates the period from beginning to completion of the activity.

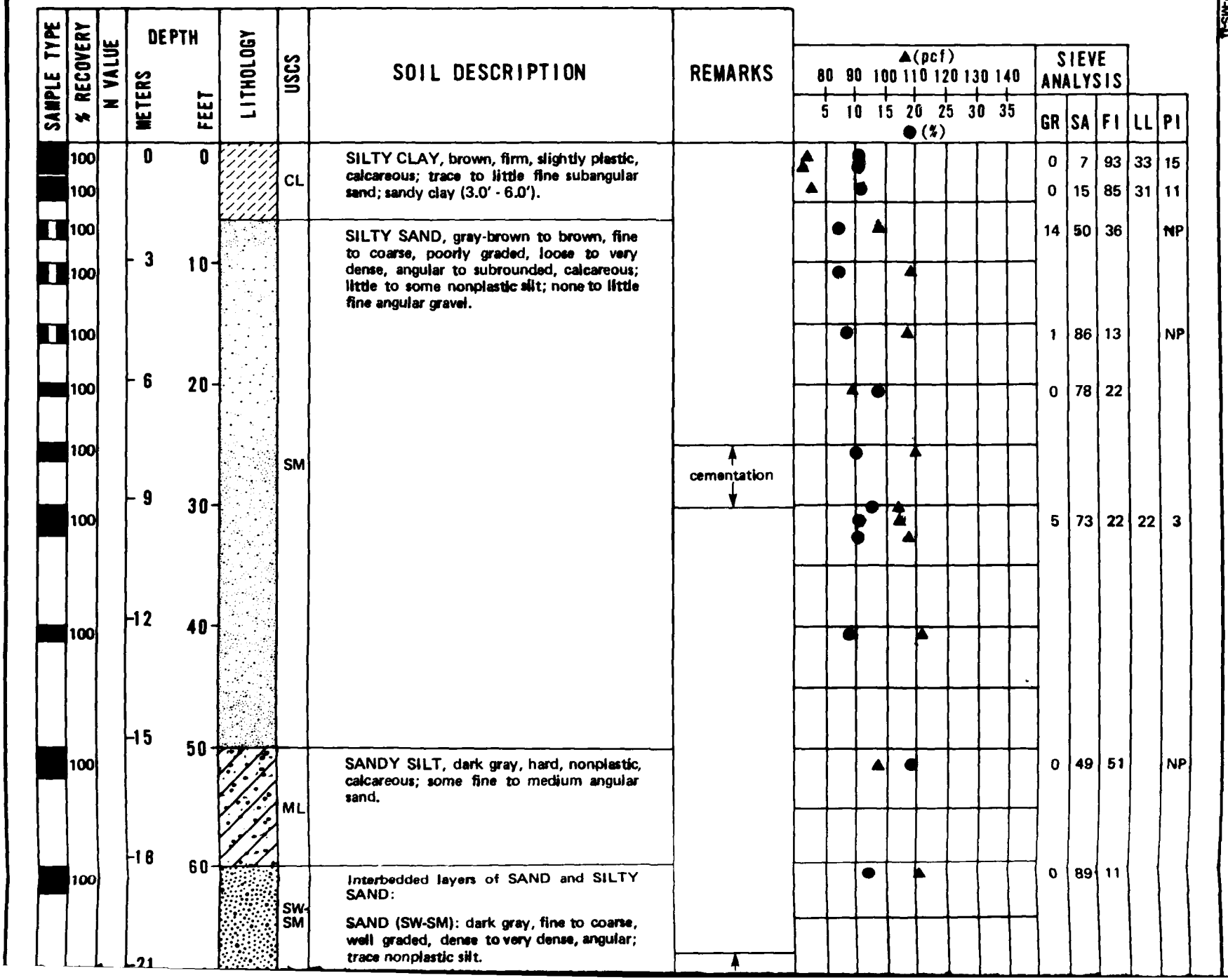
Drilling Method - signifies the type of drilling procedure used such as rotary wash.

Hole Diameter - nominal size of boring drilled.

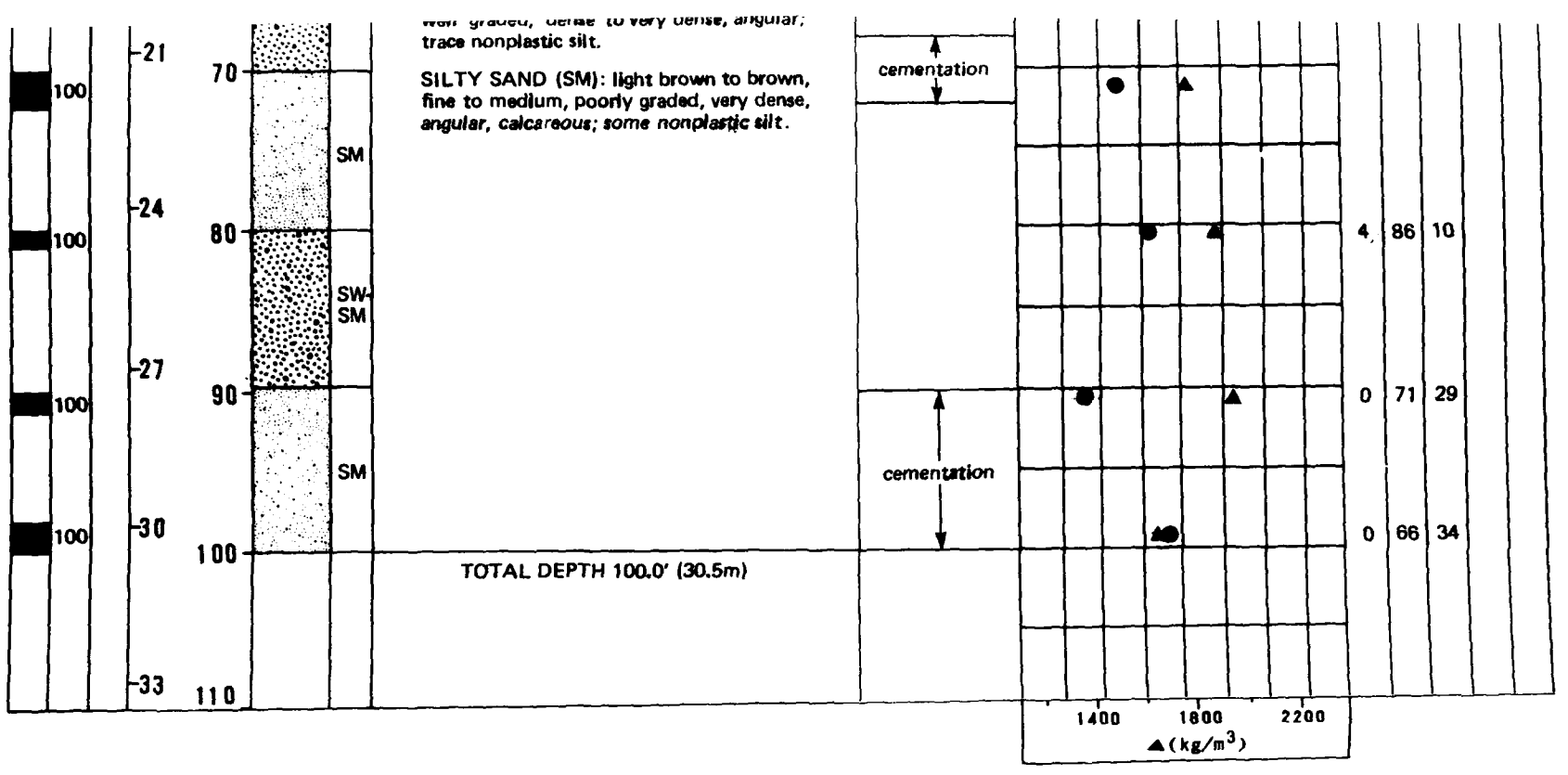
Water Level - indicates depth from ground surface to water table where encountered.

Trench Length - length at ground surface of final trench excavation.

Trench Orientation - bearing of longitudinal trench centerline.


SAMPLE TYPE
% RECOVERY
N VALUE
DEPTH
METERS
FEET
LITHOLOGY
USCS
SOIL DESCRIPTION
REMARKS
▲(pcf)
80 90 100 110 120 130 140
5 10 15 20 25 30 35
● (%)
SIEVE ANALYSIS
GR SA FI LL PI
100 100 100 100 100 100 100 100 100 100
0 3 6 9 12 15 18 21
0 10 20 30 40 50 60
CL
SM
ML
SW-SM
SILTY CLAY, brown, firm, slightly plastic, calcareous; trace to little fine subangular sand; sandy clay (3.0' - 6.0').
SILTY SAND, gray-brown to brown, fine to coarse, poorly graded, loose to very dense, angular to subrounded, calcareous; little to some nonplastic silt; none to little fine angular gravel.
SANDY SILT, dark gray, hard, nonplastic, calcareous; some fine to medium angular sand.
Interbedded layers of SAND and SILTY SAND:
SAND (SW-SM): dark gray, fine to coarse, well graded, dense to very dense, angular; trace nonplastic silt.
cementation
0 7 93 33 15
0 15 85 31 11
14 50 36 NP
1 86 13 NP
0 78 22
5 73 22 22 3
0 49 51 NP
0 89 11

E-TR-27-MS-II



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5920' (1804m)
SURFICIAL GEOLOGIC UNIT	: A1
DATE DRILLED	: 16 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

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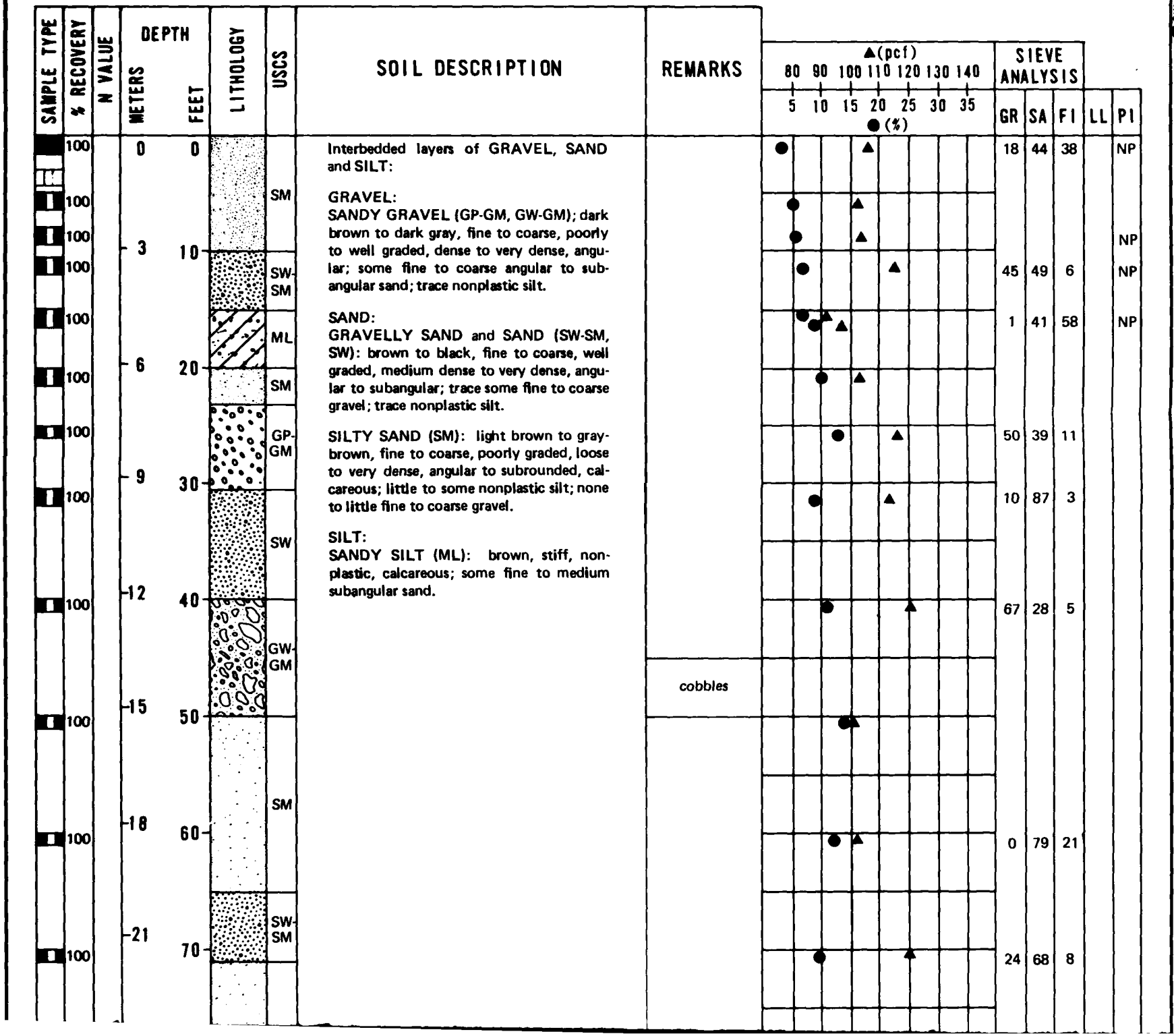
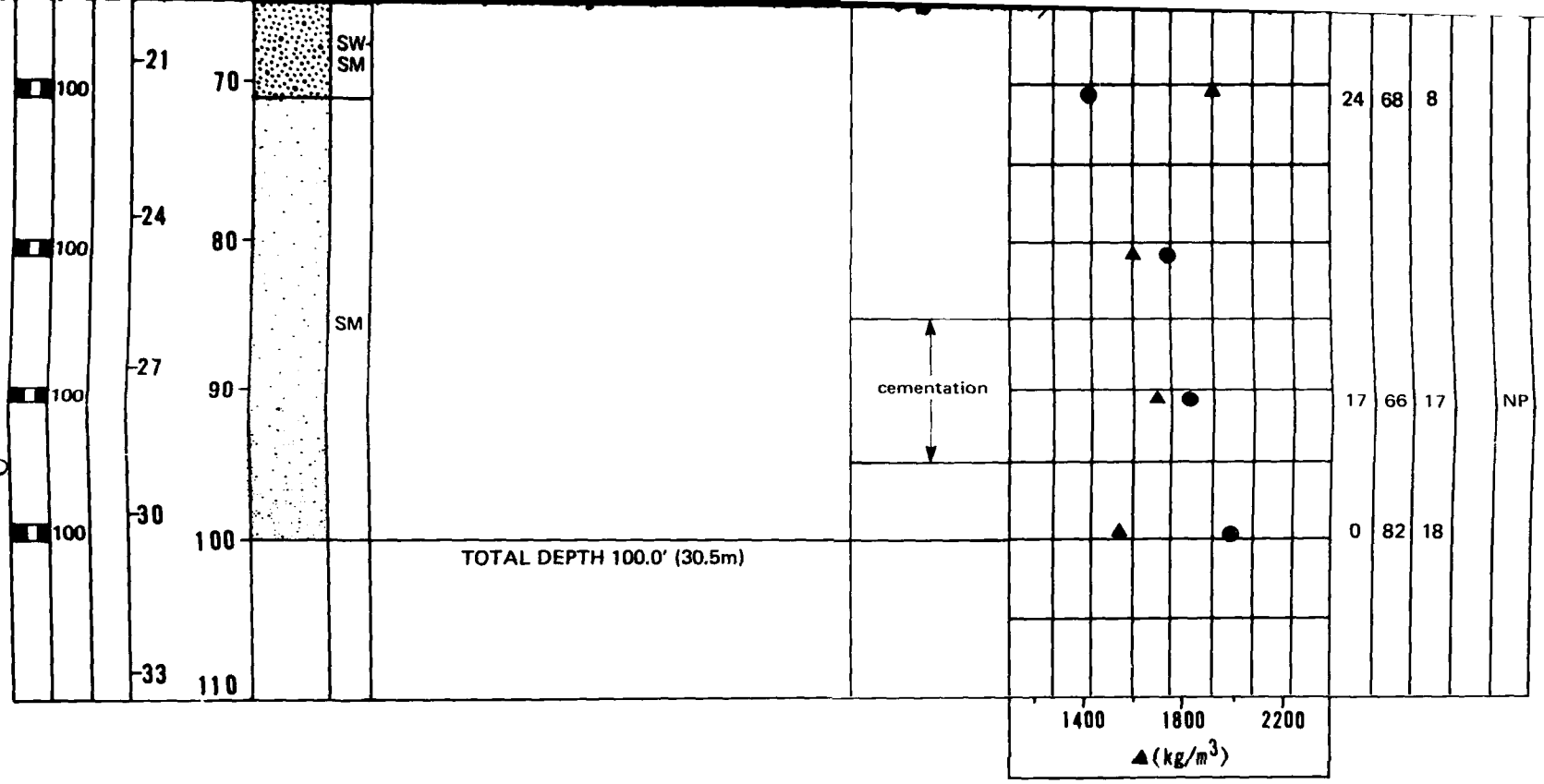
LOG OF BORING MS-B-1
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE B-1


SAMPLE TYPE
% RECOVERY
N VALUE
DEPTH
METERS
FEET
LITHOLOGY
USCS
SOIL DESCRIPTION
REMARKS
▲(pcf)
80 90 100 110 120 130 140
5 10 15 20 25 30 35
● (%)
SIEVE ANALYSIS
GR SA FI LL PI
Interbedded layers of GRAVEL, SAND and SILT:
GRAVEL:
SANDY GRAVEL (GP-GM, GW-GM); dark brown to dark gray, fine to coarse, poorly to well graded, dense to very dense, angular; some fine to coarse angular to subangular sand; trace nonplastic silt.
SAND:
GRAVELLY SAND and SAND (SW-SM, SW): brown to black, fine to coarse, well graded, medium dense to very dense, angular to subangular; trace some fine to coarse gravel; trace nonplastic silt.
SILTY SAND (SM): light brown to gray-brown, fine to coarse, poorly graded, loose to very dense, angular to subrounded, calcareous; little to some nonplastic silt; none to little fine to coarse gravel.
SILT:
SANDY SILT (ML): brown, stiff, nonplastic, calcareous; some fine to medium subangular sand.
cobbles
SM
SW-SM
ML
SM
GP-GM
SW
GW-GM
SM
SW-SM
100
0 0
3 10
6 20
9 30
12 40
15 50
18 60
21 70
18 44 38 NP
45 49 6 NP
1 41 58 NP
50 39 11
10 87 3
67 28 5
0 79 21
24 68 8



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	: 5360' (1634m)
SURFICIAL GEOLOGIC UNIT	: A5i
DATE DRILLED	: 17 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING MS-B-2
MULESHOE VALLEY, NEVADA

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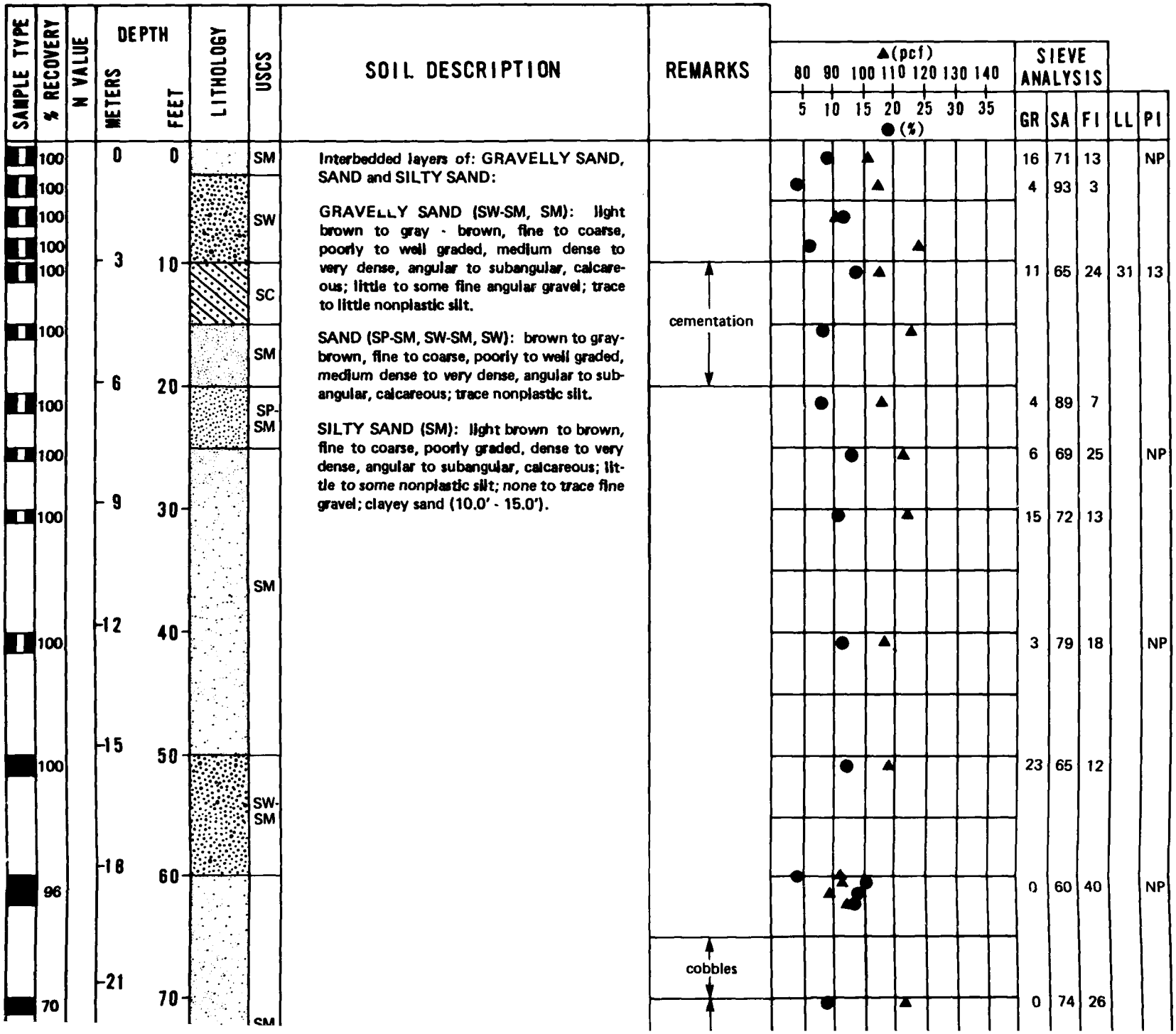
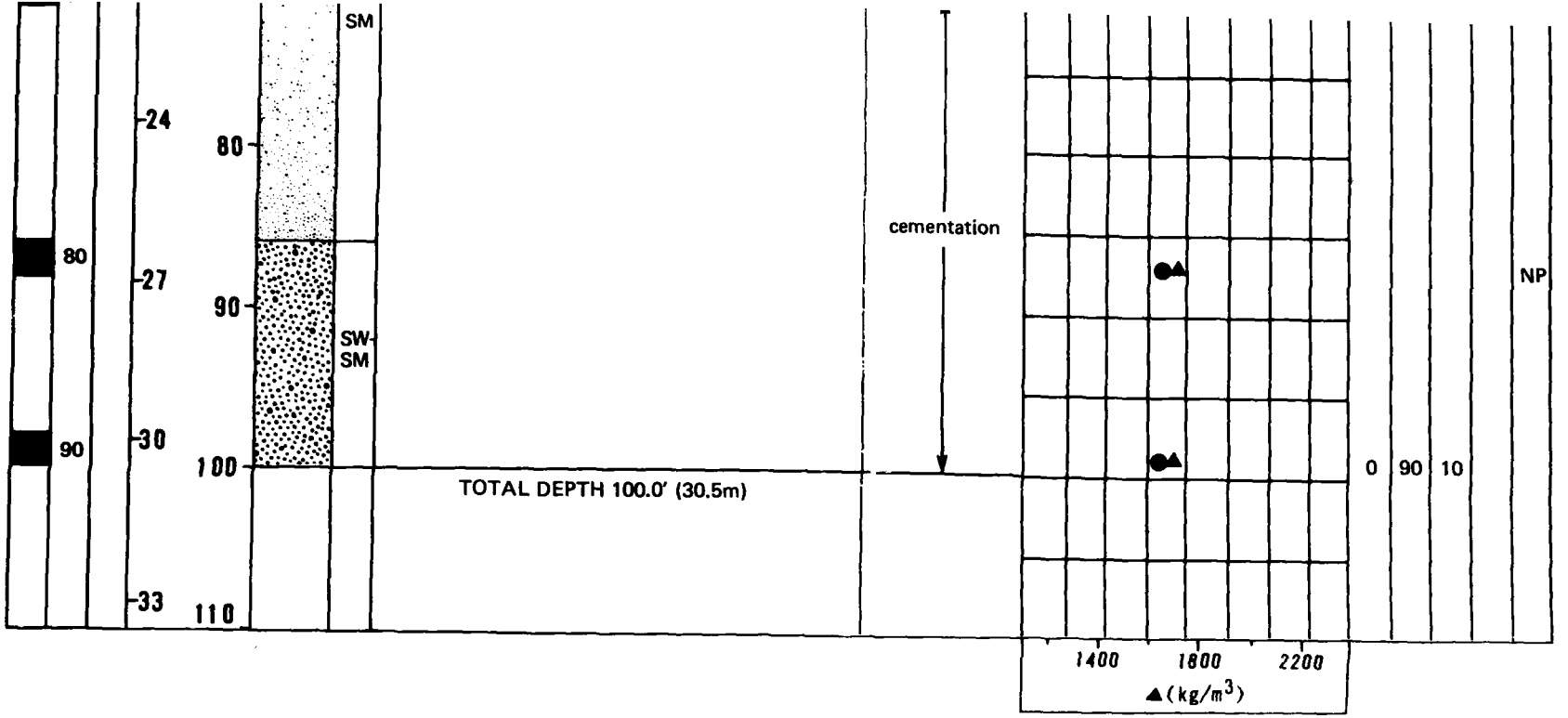
FIGURE II-4-2


SAMPLE TYPE
% RECOVERY
N VALUE
DEPTH
METERS
FEET
LITHOLOGY
USCS
SOIL DESCRIPTION
REMARKS
▲(pcf)
80 90 100 110 120 130 140
5 10 15 20 25 30 35
● (%)
SIEVE ANALYSIS
GR SA FI LL PI
100 0 0 SM
100
100 SW
100 3 10
100 SC
100 SM
100 6 20 SP-SM
100
100 9 30
SM
100 12 40
100 15 50 SW-SM
96 18 60
70 21 70 SM
Interbedded layers of: GRAVELLY SAND, SAND and SILTY SAND:
GRAVELLY SAND (SW-SM, SM): light brown to gray - brown, fine to coarse, poorly to well graded, medium dense to very dense, angular to subangular, calcareous; little to some fine angular gravel; trace to little nonplastic silt.
SAND (SP-SM, SW-SM, SW): brown to gray-brown, fine to coarse, poorly to well graded, medium dense to very dense, angular to subangular, calcareous; trace nonplastic silt.
SILTY SAND (SM): light brown to brown, fine to coarse, poorly graded, dense to very dense, angular to subangular, calcareous; little to some nonplastic silt; none to trace fine gravel; clayey sand (10.0' - 15.0').
cementation
cobbles
16 71 13 NP
4 93 3
11 65 24 31 13
4 89 7
6 69 25 NP
15 72 13
3 79 18 NP
23 65 12
0 60 40 NP
0 74 26



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5700' (1737m)
SURFICIAL GEOLOGIC UNIT	: A5i
DATE DRILLED	: 18 November 1979
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

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LOG OF BORING MS-B-3
MULESHOE VALLEY, NEVADA

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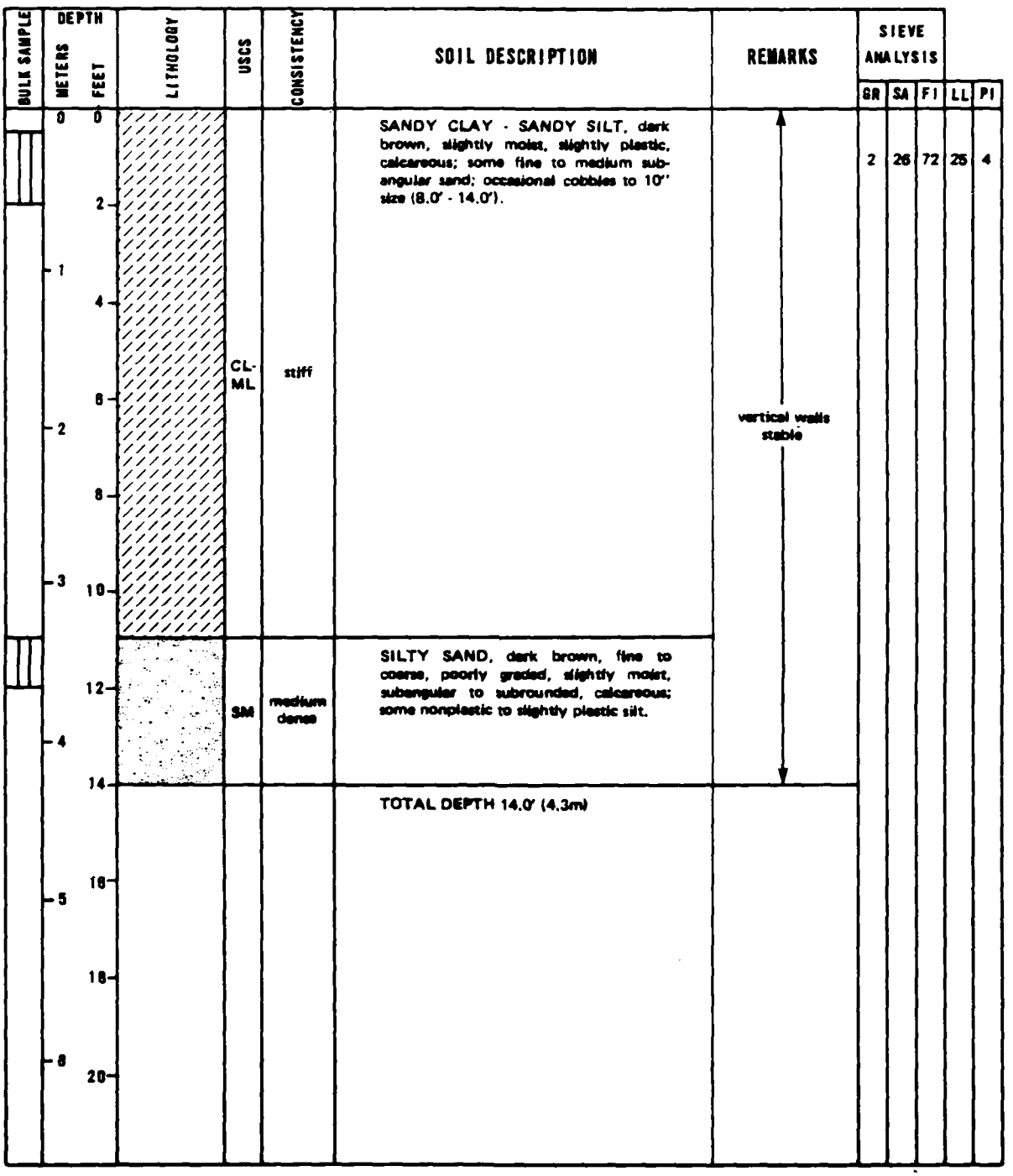
FIGURE II-6-3

7.0 TRENCH AND TEST PIT LOGS

See Section 6.0, "Boring Logs," for explanation.

E-TR-27-MS-II



TRENCH DETAILS

SURFACE ELEVATION	: 6230' (1898m)
DATE EXCAVATED	: 20 October 1979
SURFICIAL GEOLOGIC UNIT	: Asi
TRENCH LENGTH	: 16.0' (4.9m)
TRENCH ORIENTATION	: E - W

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LOG OF TRENCH MS-T-1
MULESHOE VALLEY, NEVADA

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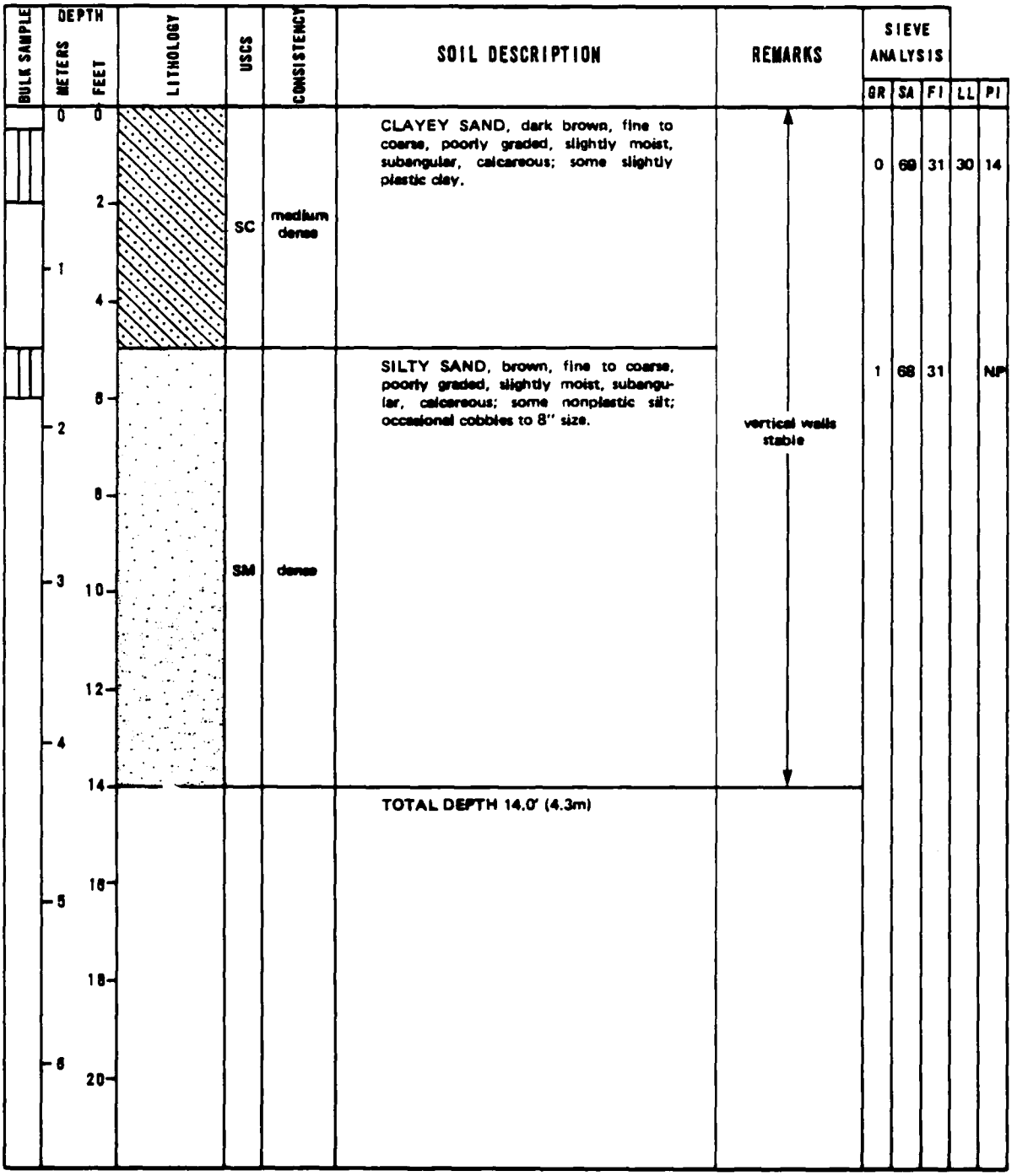
FIGURE II-7-1

E-TR-27-MS-II



TRENCH DETAILS

SURFACE ELEVATION : 5990' (1826m)
DATE EXCAVATED : 21 October 1979
SURFICIAL GEOLOGIC UNIT : A5o
TRENCH LENGTH : 18.0' (4.9m)
TRENCH ORIENTATION : E - W

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LOG OF TRENCH MS-T-2
MULESHOE VALLEY, NEVADA

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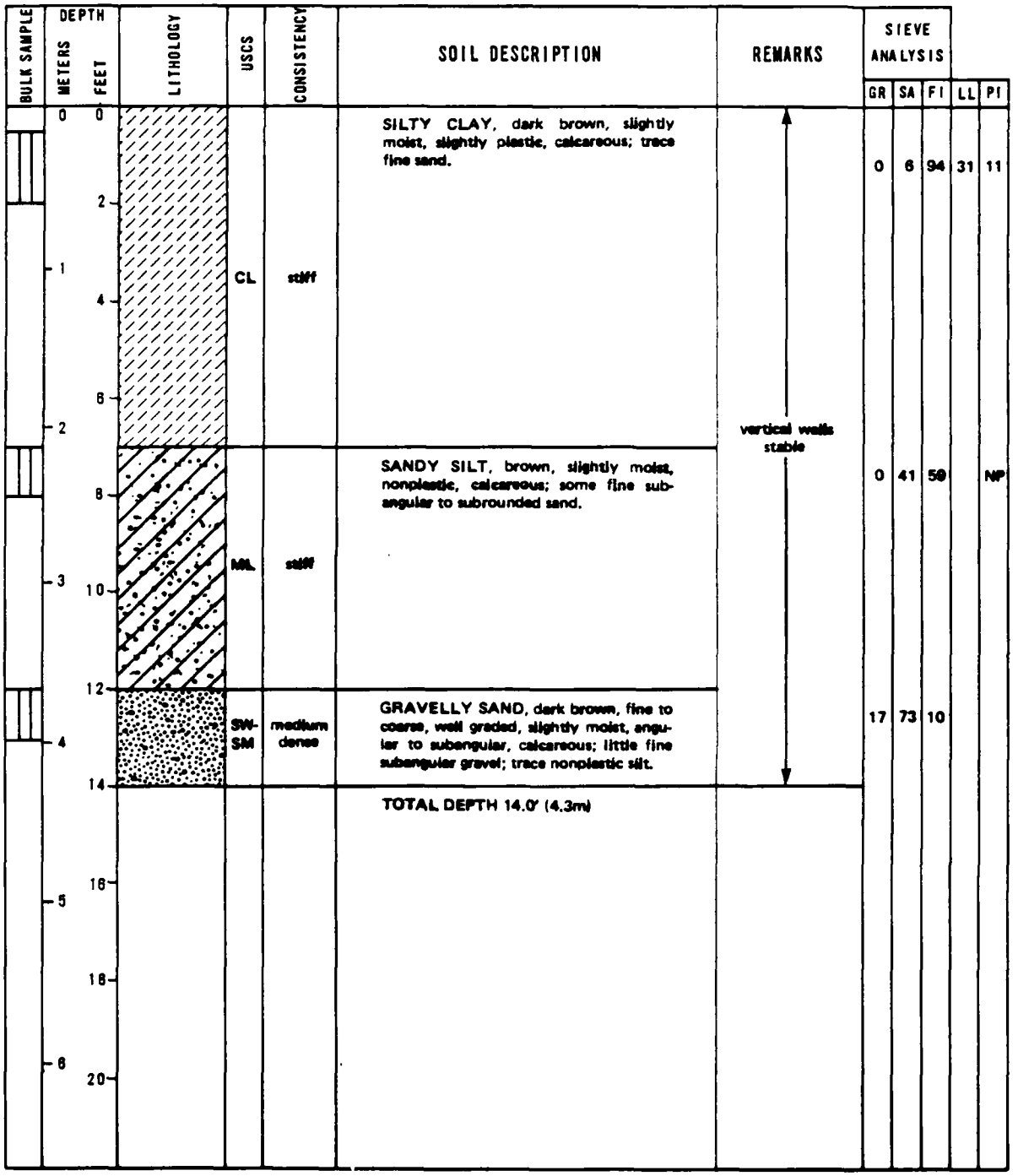
FIGURE II-7-2

E-TR-27-MS-II



TRENCH DETAILS

SURFACE ELEVATION : 5920' (1804m)
DATE EXCAVATED : 21 October 1979
SURFICIAL GEOLOGIC UNIT : A1
TRENCH LENGTH : 16.0' (4.9m)
TRENCH ORIENTATION : N - S

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LOG OF TRENCH MS-T-3
MULESHOE VALLEY, NEVADA

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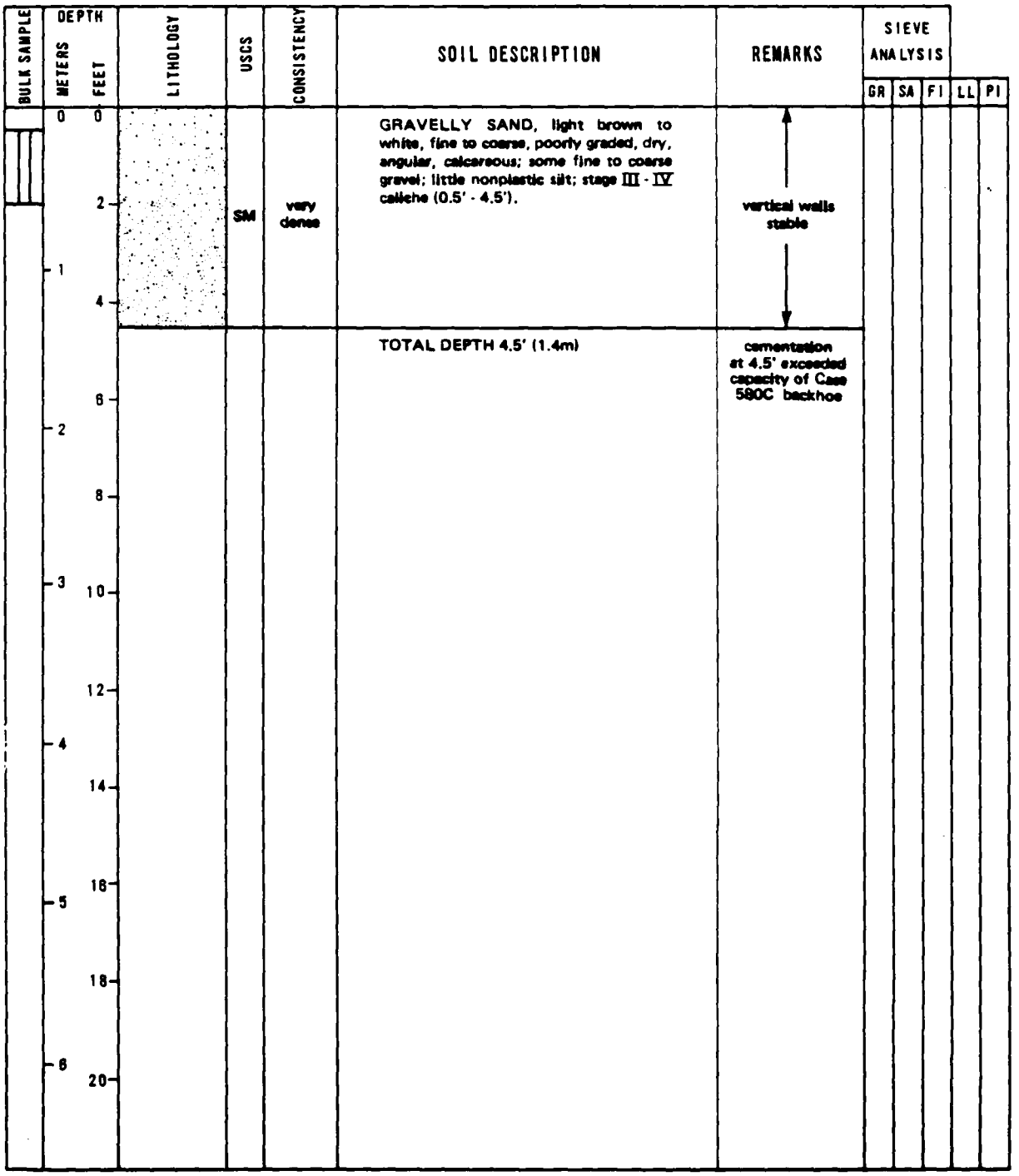
FIGURE II-7-3

E-TR-27-MS-II



TRENCH DETAILS

SURFACE ELEVATION	: 6100' (1860m)
DATE EXCAVATED	: 30 October 1979
SURFICIAL GEOLOGIC UNIT	: Aso
TRENCH LENGTH	: 8.0' (2.4m)
TRENCH ORIENTATION	: N - S

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LOG OF TRENCH MS-T-4
MULESHOE VALLEY, NEVADA

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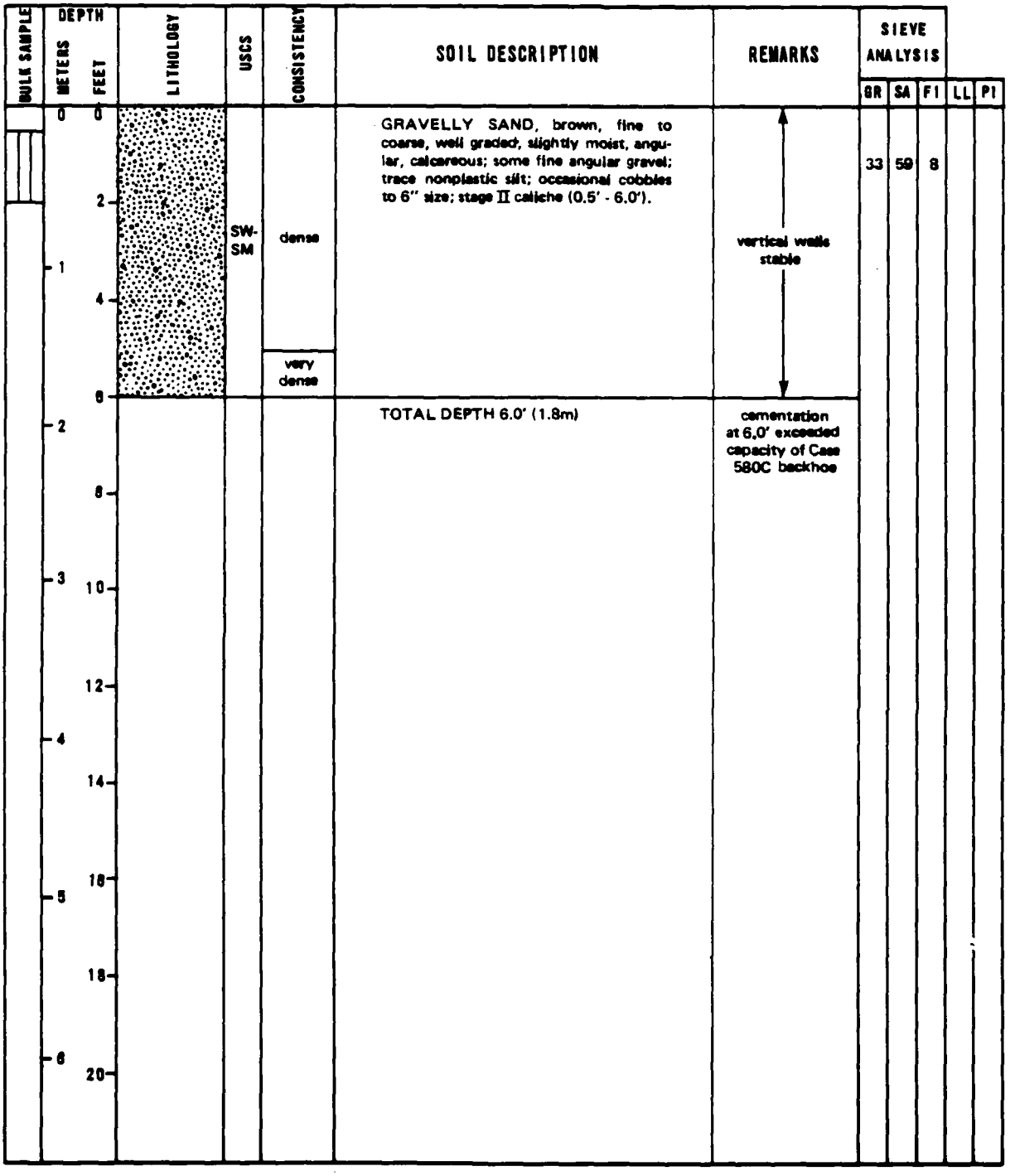
FIGURE II-7-4

E-TR-27-MS-II



TRENCH DETAILS

SURFACE ELEVATION : 5700' (1737m)
DATE EXCAVATED : 30 October 1979
SURFICIAL GEOLOGIC UNIT : Asi
TRENCH LENGTH : 8.0' (2.4m)
TRENCH ORIENTATION : E - W

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LOG OF TRENCH MS-T-5
MULESHOE VALLEY, NEVADA

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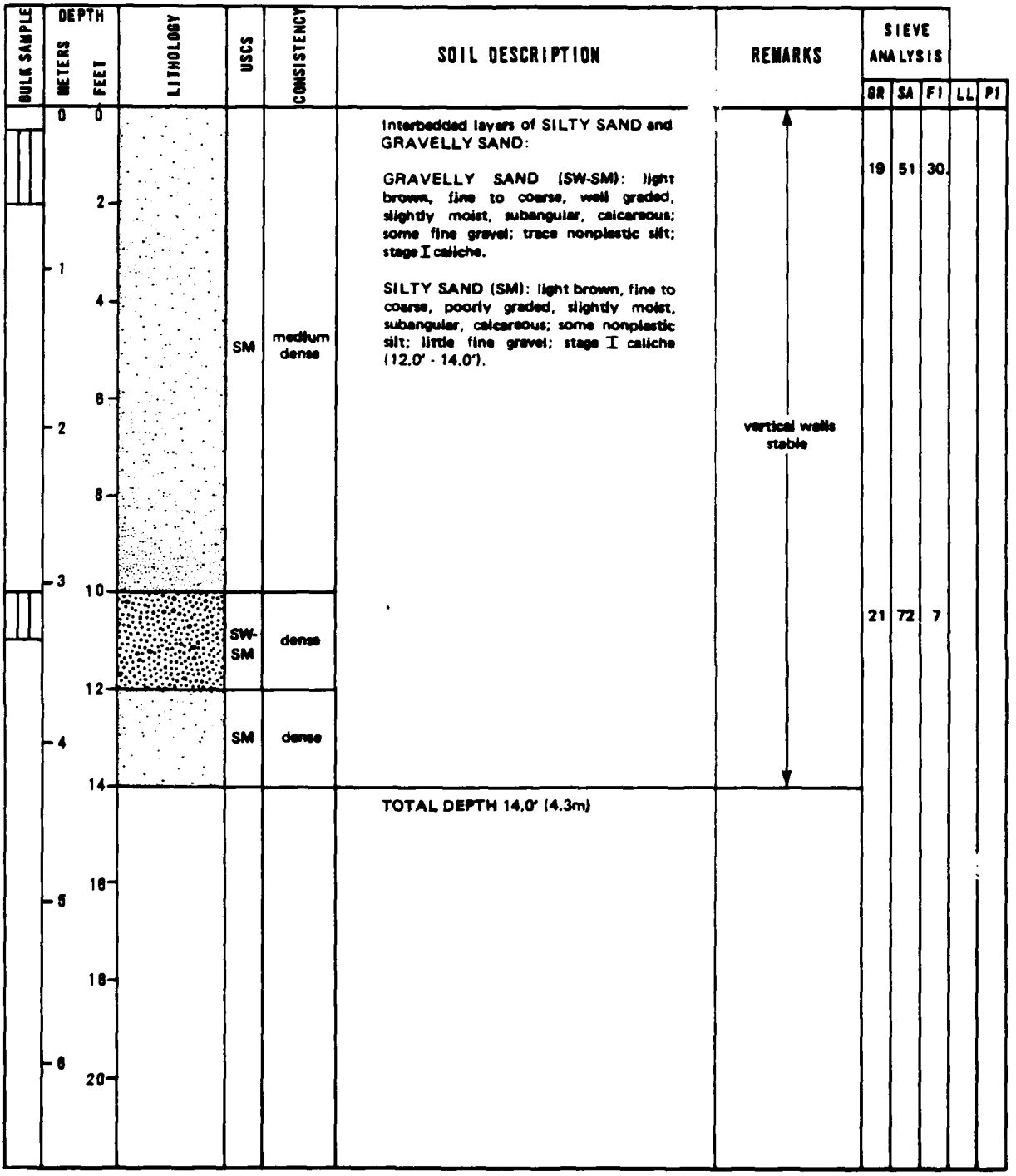
FIGURE II-7-6

E-TR-27-MS-II



TRENCH DETAILS

SURFACE ELEVATION : 5360' (1634m)
DATE EXCAVATED : 31 October 1979
SURFICIAL GEOLOGIC UNIT : A5i
TRENCH LENGTH : 16.0' (4.9m)
TRENCH ORIENTATION : E - W

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LOG OF TRENCH MS-T-6
MULESHOE VALLEY, NEVADA

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FIGURE II-7-6

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0										
				GM	dense	SANDY GRAVEL, light brown, fine to coarse, poorly graded, slightly moist, angular, calcareous; some fine to coarse sand; little nonplastic silt; stage III caliche (2.0' - 3.0').	vertical walls stable	56	30	14		
		2										
	1					TOTAL DEPTH 3.0' (0.9m)	cementation at 3.0' exceeded capacity of Case 580C backhoe					
		4										
		6										
	2											
		8										
	3	10										
		12										
	4											
		14										
		16										
	5											
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 5630' (1716m)
DATE EXCAVATED : 30 October 1979
SURFICIAL GEOLOGIC UNIT : Qsi
TRENCH LENGTH : 7.0' (2.1m)
TRENCH ORIENTATION : E - W

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LOG OF TRENCH MS-T-7
MULESHOE VALLEY, NEVADA

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FIGURE II-7-7

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		GC	dense	CLAYEY GRAVEL, brown, fine to coarse, poorly graded, dry, angular to subangular, calcareous; some slightly plastic clay; some fine to coarse sand; stage II caliche (0.5' - 2.0') stage IV caliche at 2.5'.	vertical walls stable	43	28	31	32	11
		2			very dense							
	1	4				TOTAL DEPTH 2.5' (0.8m)	cementation at 2.5' exceeded capacity of Case 580C backhoe					
		6										
	2	8										
	3	10										
		12										
	4	14										
	5	16										
		18										
	6	20										

TRENCH DETAILS

SURFACE ELEVATION : 5860' (1786m)
DATE EXCAVATED : 1 November 1979
SURFICIAL GEOLOGIC UNIT : Asi
TRENCH LENGTH : 6.0' (1.8m)
TRENCH ORIENTATION : E - W

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LOG OF TRENCH MS-T-8
MULESHOE VALLEY, NEVADA

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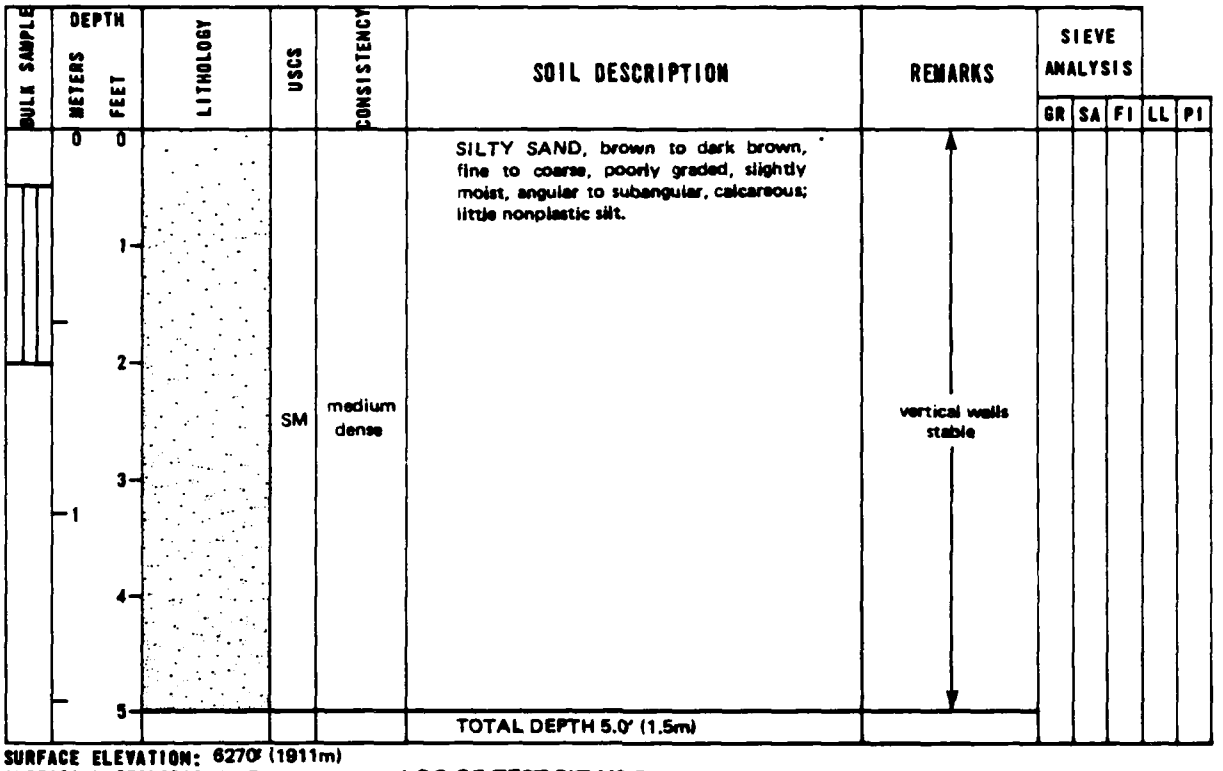
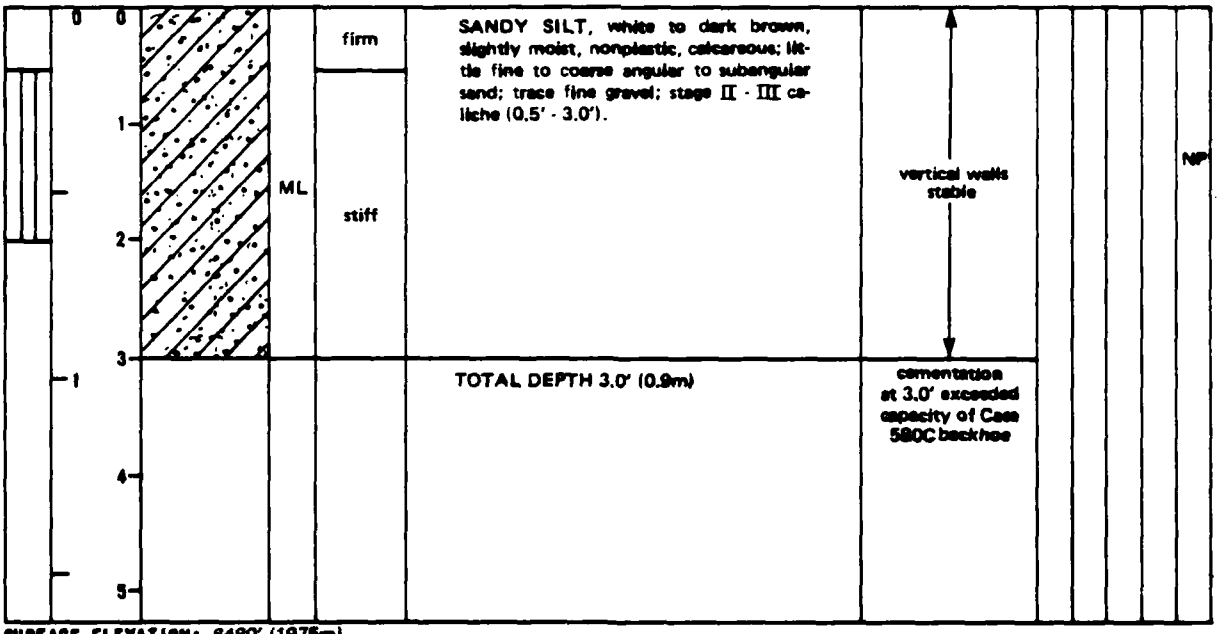
FIGURE II-7-8

E-TR-27-MS-II



SURFACE ELEVATION: 6270' (1911m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT MS-P-1



SURFACE ELEVATION: 6480' (1975m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT MS-P-2

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LOGS OF TEST PITS MS-P-1 AND MS-P-2
MULESHOE VALLEY, NEVADA

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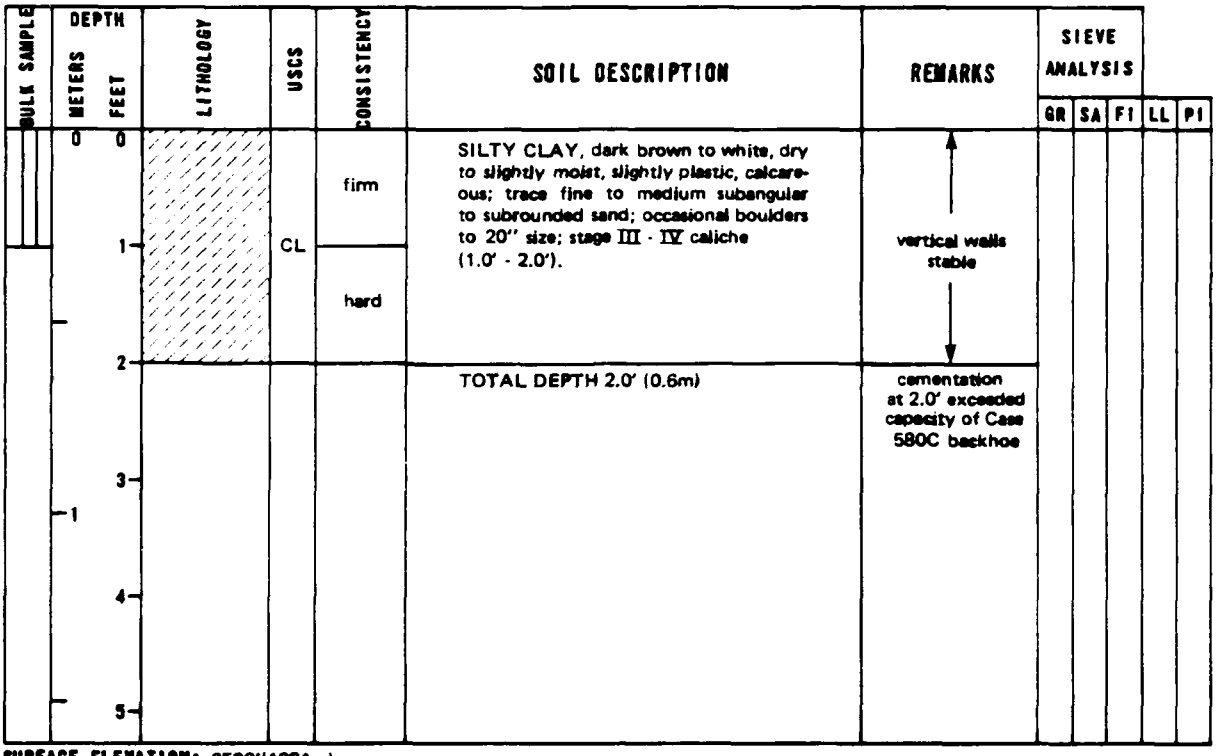
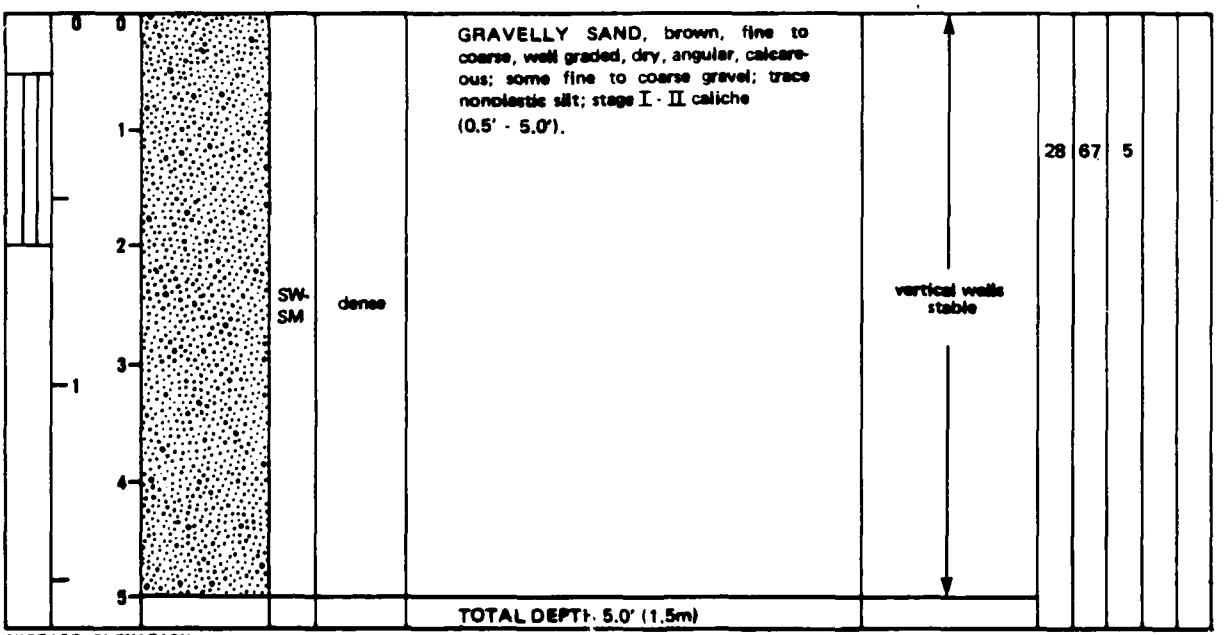
FIGURE II-7-9



SURFACE ELEVATION: 6500'(1981m)
SURFICIAL GEOLOGIC UNIT: A5o

LOG OF TEST PIT MS-P-3



SURFACE ELEVATION: 5820'(1774m)
SURFICIAL GEOLOGIC UNIT: A5o

LOG OF TEST PIT MS-P-4

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LOGS OF TEST PITS MS-P-3 AND MS-P-4 MULESHOE VALLEY, NEVADA

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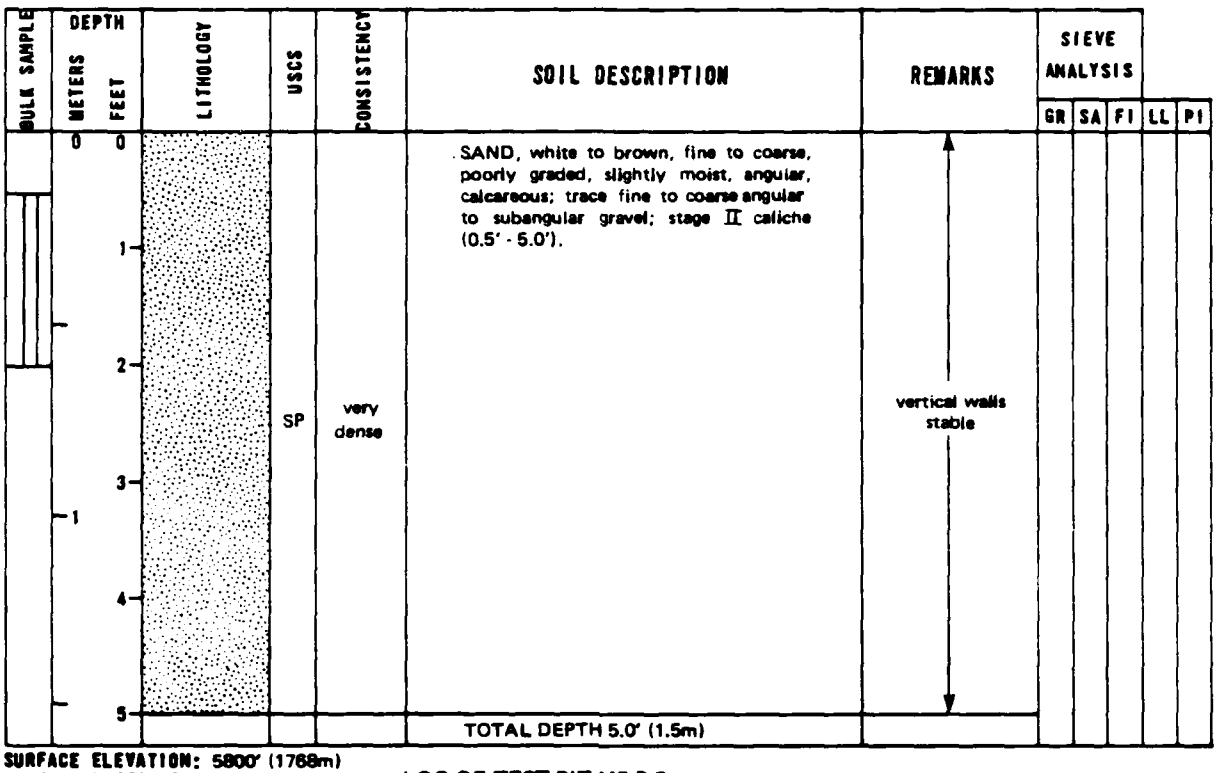
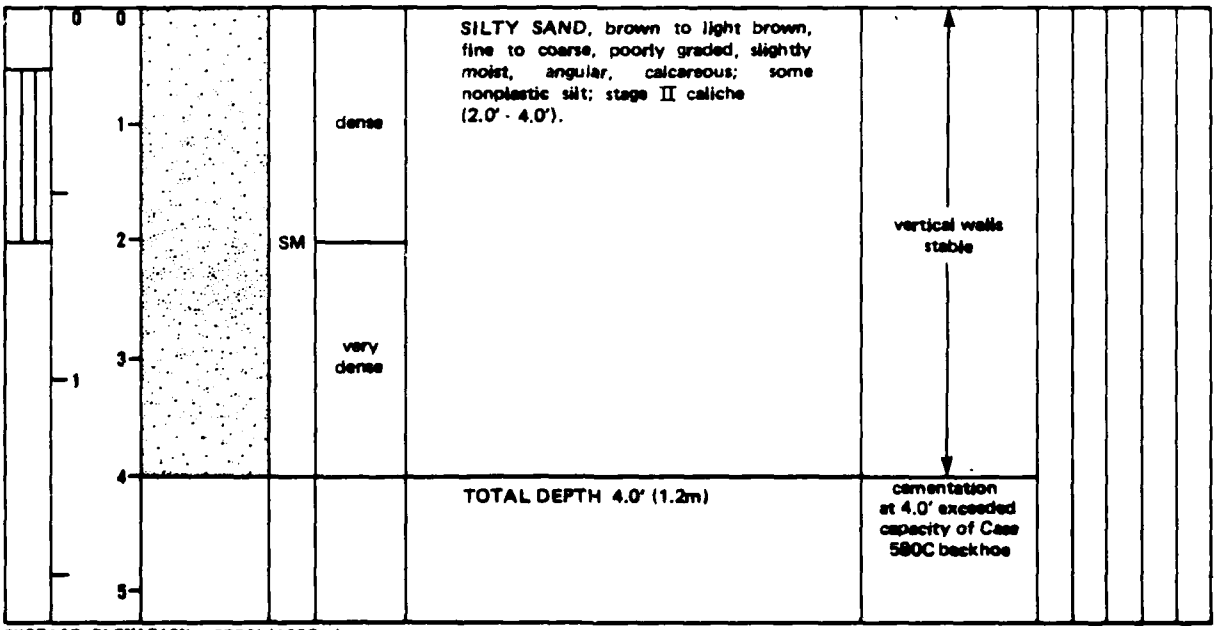
FIGURE II-7-10

E-TR-27-MS-II



SURFACE ELEVATION: 5800' (1768m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT MS-P-5



SURFACE ELEVATION: 5660' (1692m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT MS-P-6

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LOGS OF TEST PITS MS-P-5 AND MS-P-6
MULESHOE VALLEY, NEVADA

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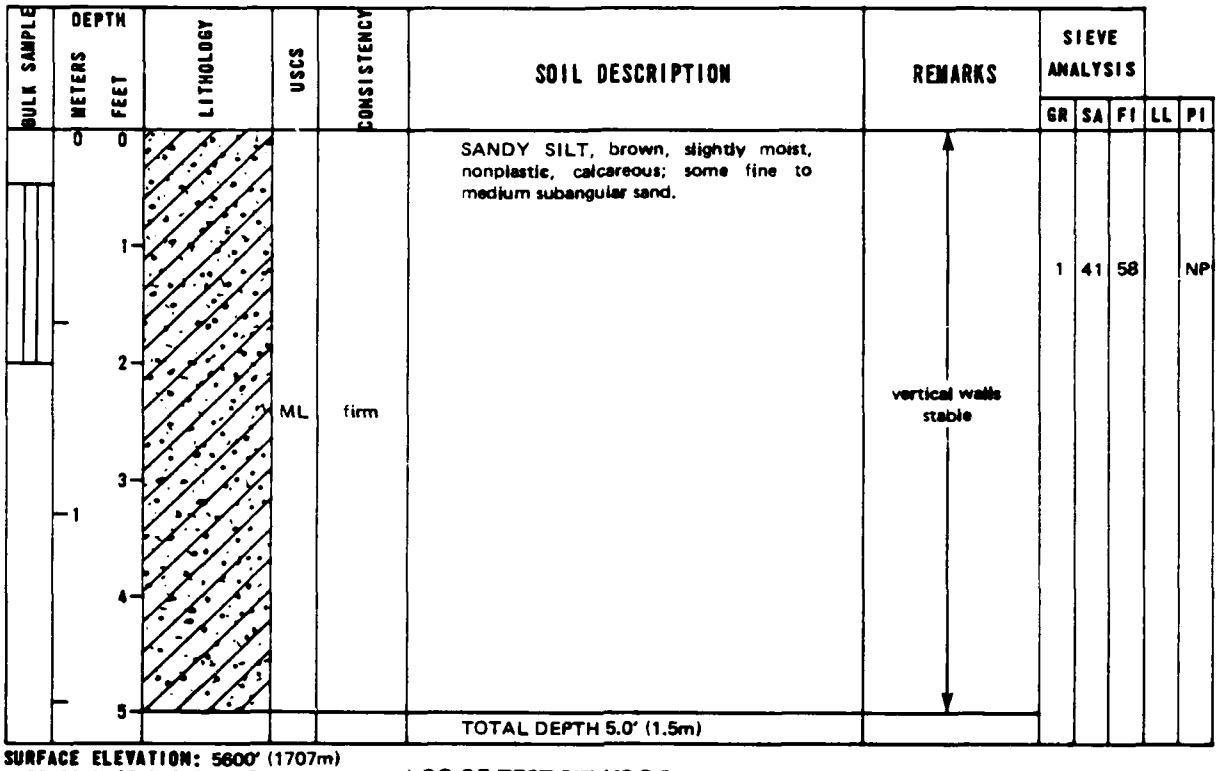
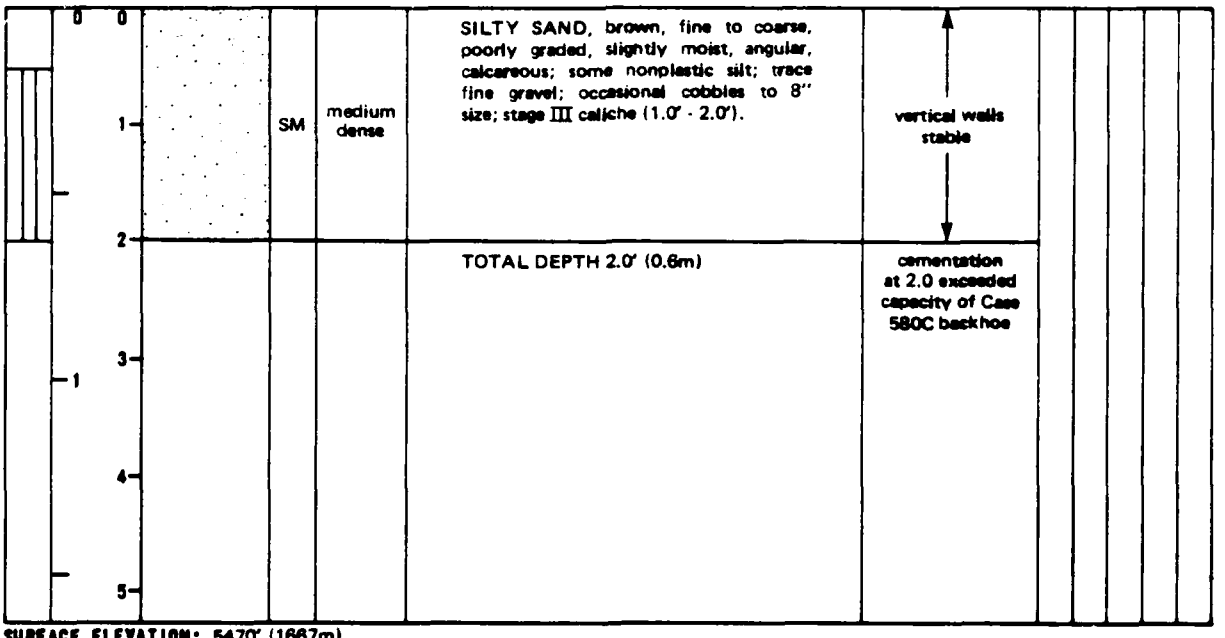
FIGURE II-7-11



SURFACE ELEVATION: 5600' (1707m)
SURFICIAL GEOLOGIC UNIT: A1

LOG OF TEST PIT MS-P-7



SURFACE ELEVATION: 5470' (1667m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT MS-P-8

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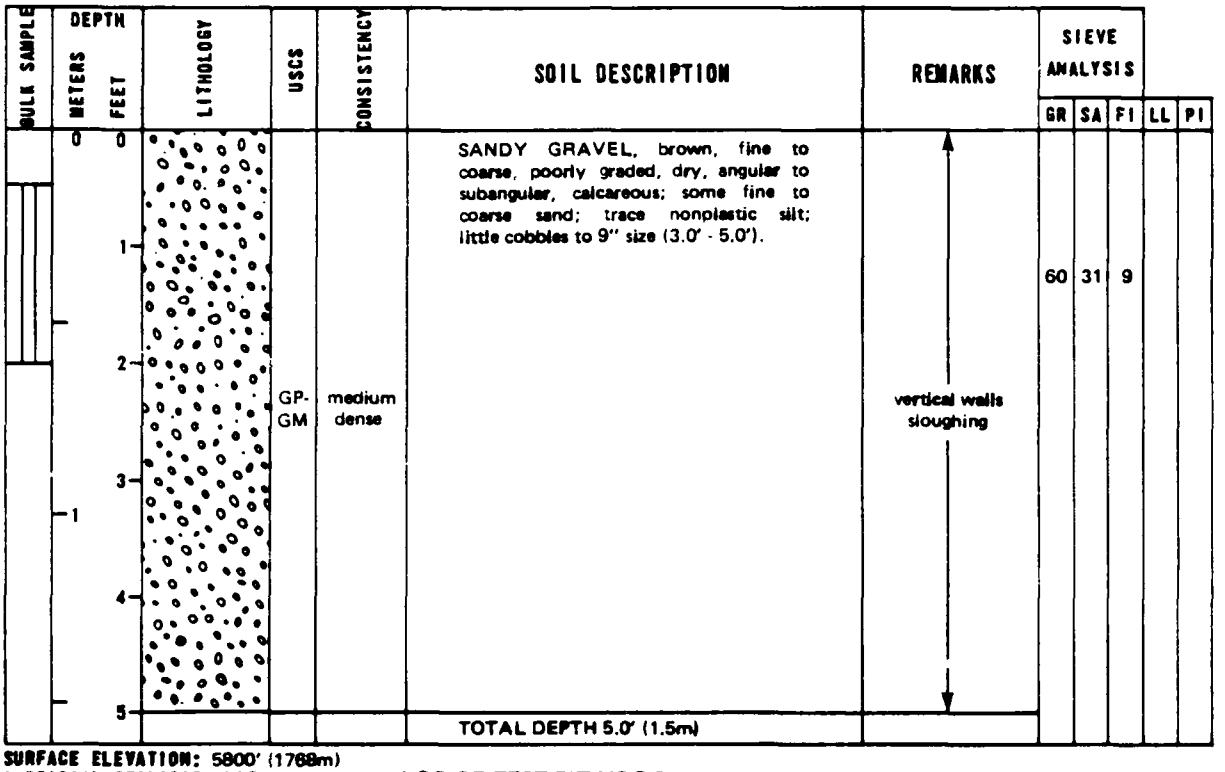
LOGS OF TEST PITS MS-P-7 AND MS-P-8
MULESHOE VALLEY, NEVADA

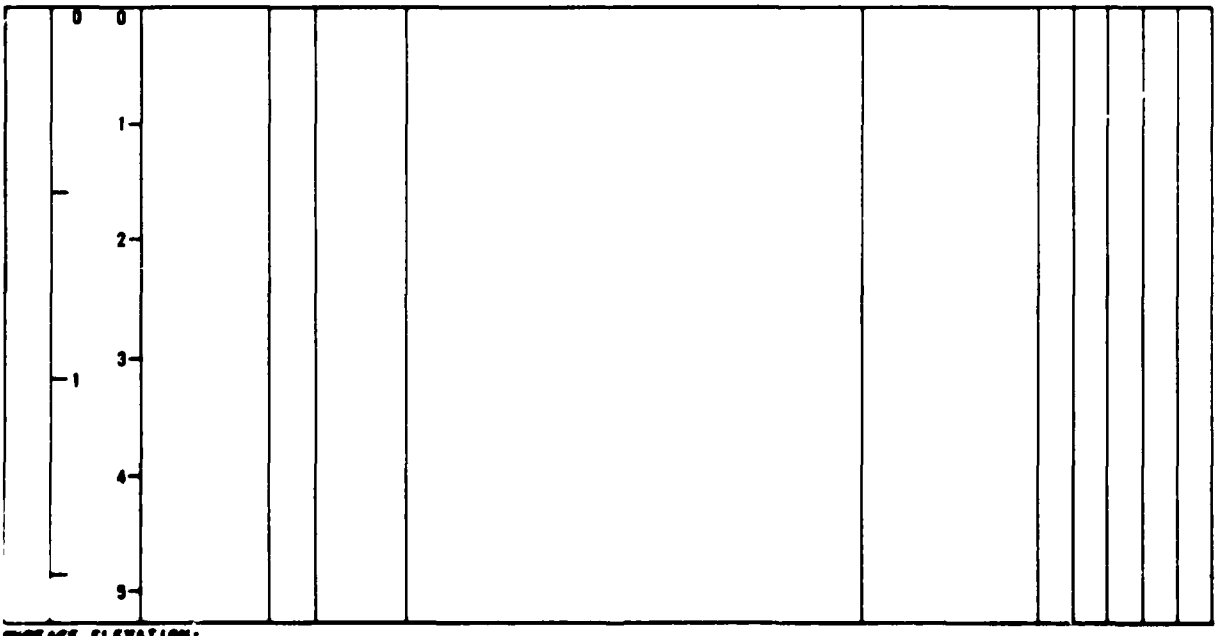
30 JUN 81

FIGURE II-7-12



SURFACE ELEVATION: 5800' (1768m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT MS-P-9



SURFACE ELEVATION:
SURFICIAL GEOLOGIC UNIT:

LOG OF TEST PIT

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LOG OF TEST PIT MS-P-9
MULESHOE VALLEY, NEVADA

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FIGURE II-7-13

ACTIVITY NUMBER	GROUND SURFACE ELEVATION, FEET (METERS)	SURFICIAL GEOLOGIC UNIT	DEPTH, FEET (METERS)	USCS	SOIL DESCRIPTION	SIEVE ANALYSIS GR	SA	FI	LL	PI
MS-CS-5	6080 (1853)	A5i	0.0 - 0.5 (0.0 - 0.2)	GC	CLAYEY GRAVEL, dark brown, fine to coarse, poorly graded, subangular to subrounded, calcareous; some slightly plastic clay; little fine to coarse sand.	46	19	35	33	12
			0.5 - 1.0 (0.2 - 0.3)	GP	SANDY GRAVEL, white, fine to coarse, poorly graded, subangular to subrounded, calcareous; little fine to coarse sand; some cobbles to 10" size; stage IV caliche (0.5' - 1.0').					
MS-CS-8	5960 (1817)	A5o	0.0 - 2.0 (0.0 - 0.6)	SM	GRAVELLY SAND, light brown, fine to coarse, poorly graded, angular, calcareous; some fine to coarse gravel; little nonplastic silt; stage II - III caliche (0.5' - 2.0').					
MS-CS-10	5690 (1734)	A5i	0.0 - 2.0 (0.0 - 0.6)	ML	SILT, brown, slightly plastic, calcareous; trace fine subangular sand.					
MS-CS-12	5510 (1679)	A5i	0.0 - 4.0 (0.0 - 1.2)	GM	SANDY GRAVEL, light brown, fine, poorly graded, subangular, calcareous; some fine to coarse sand; some nonplastic to slightly plastic silt; boulder to 24" size at 2.5'.	38	31	31		
MS-CS-13	6000 (1829)	A5i	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, angular, calcareous; some nonplastic silt.					
MS-CS-18	5740 (1750)	A5i	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, light brown, fine to coarse, poorly graded, angular to subangular, calcareous; some nonplastic to slightly plastic silt; occasional cobbles to 7" size.					
MS-CS-20	5450 (1661)	A5y	0.0 - 2.0 (0.0 - 0.6)	ML	SANDY SILT, light brown, nonplastic, calcareous; little fine subangular sand.	0	18	82		NP
MS-CS-23	5400 (1646)	A5i	0.0 - 2.0 (0.0 - 0.6)	SM	SILTY SAND, light brown, fine to coarse, poorly graded, subangular, calcareous; little nonplastic silt.					

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LOGS OF SURFICIAL SOIL SAMPLES
MULESHOE VALLEY, NEVADA

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FIGURE II-6-1

8.0 SURFICIAL SOIL SAMPLE LOGS

Explanation: Finalized logs of the surficial samples are presented in this section. Explanations of the column headings on the logs follow:

A. Designations - Surficial samples are identified as follows:

MS-CS-1
MS - abbreviation for the valley (e.g., MS-Muleshoe)
CS - abbreviation for surficial sample
1 - number of activity

B. Ground Surface Elevation - Indicated elevations on the logs are estimated from topographic maps of the study area within an accuracy of half the contour interval.

C. Surficial Geologic Unit - Indicates the surficial geologic unit in which the activity is located.

D. Depth - Indicates depth interval for which soil description is given.

E. USCS - Unified Soil Classification Symbol; see Table II-6-1 of Section 6.0, "Borings Logs," for details of USCS.

F. Soil Description - Soil is described based on field visual descriptions and/or laboratory test results. See Section 6.0, "Boring Logs," for procedures of soil description.

G. Sieve Analysis, LL and PI - These are from results of laboratory tests. See Section 6.0, "Boring Logs," for explanation.

9.0 LABORATORY TEST RESULTS

Explanation: Laboratory test results are presented in this section. Table II-9-1 contains a summary of laboratory test results. This table shows results of sieve analysis; plasticity data; in-situ dry unit weight, moisture content, degree of saturation, and void ratio for drive and Pitcher samples; results of compaction tests; and specific gravity of solids. Other tests such as triaxial compression, unconfined compression, direct shear, consolidation, chemical, and California Bearing Ratio (CBR) are indicated on the table. Tables II-9-2 through II-9-6 and Figures II-9-1 through II-9-3 present results of triaxial compression, unconfined compression, direct shear, consolidation, chemical, and CBR tests.

All tests were performed in general accordance with the American Society for Testing and Materials (ASTM) procedures. The following list presents the ASTM designations for the tests performed during the investigation.

Type of Test	ASTM Designations
Particle Size Analysis	D 422-63
Liquid Limit	D 423-66
Plastic Limit	D 424-59
Unit Weight	D 2937-71
Moisture Content	D 2216-71
Compaction	D 1557-70
Specific Gravity of Solids	D 854-58
Triaxial	D 2850-70
Unconfined Compression	D 2166-66
Direct Shear	D 3080-72
Consolidation	D 2435-70
Test for Alkalinity (pH)	D 1067-70
Water Soluble Sodium	D 1428-64
Water Soluble Chloride	D 512-67
Water Soluble Sulphate	D 516-68
Water Soluble Calcium	D 511-72
Calcium Carbonate	D 1126-67
California Bearing Ratio (CBR)	D 1883-73

Explanation for the tables and figures presented in this section are as follows.

A. Activity Number - Boring, trench, test pit, or surface sample designation.

B. Sample Number - Prefix indicates the type of sample; explanation is at the bottom of the table.

C. Sample Interval - This is the depth range measured from ground surface over which the sample was obtained.

D. Percent Finer by Weight - Presents the results of laboratory particle size analysis (ASTM D 422-63) performed on representative soil samples at the depth indicated. The numbers represent the percent (by dry weight) of the total sample weight passing through each sieve size indicated.

E. Atterberg Limits (ASTM D 423-66 and D 424-59)

LL - Liquid Limit, the water content (as percent of soil dry weight) corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

F. USCS - Unified Soil Classification Symbols are given here; see Table II-6-1 in Section 6.0, "Boring Logs," for complete details of USCS system.

G. In Situ - Presents results of tests on drive and Pitcher samples.

Dry Unit Weight - Indicates dry unit weight of soil determined as per ASTM D 2937-71.

Moisture Content - Weight of water reported in percent of dry weight of soil sample (ASTM D 2216-71).

Saturation - The degree of saturation in a soil sample is defined as the ratio (in percent) of the volume of water to the volume of all voids in the soil.

Void Ratio - The numerical ratio of the volume of voids to the volume of solids in a soil specimen.

H. Compacted - Indicates results of laboratory maximum dry density and optimum moisture content test as per ASTM D 1557-70.

I. Specific Gravity of Solids (ASTM D 854-58) - Indicates the ratio of 1) the weight in air of a given volume of soil solids at a stated temperature, to 2) the weight in air of an equal volume of distilled water at a stated temperature.

J. Triaxial - The triaxial compression tests were performed in accordance with the procedures of ASTM D 2850-70. The following explanations and definitions apply.

Triaxial Compression Test - A cylindrical specimen of soil is surrounded by a fluid in a pressure chamber and subjected to an isotropic pressure. An additional compressive load is then applied, directed along the axis of the specimen called the axial load.

Consolidated-Drained (CD) Test - A triaxial compression test in which the soil was first consolidated under an all-around confining stress (test chamber pressure) and was then compressed (and hence sheared) by increasing the vertical stress. "Drained" indicates that excess pore water pressure generated by strains are permitted to dissipate by the free movement of pore water during consolidation and compression.

Consolidated-Undrained (CU) Test - A triaxial compression test in which essentially complete consolidation under the confining (chamber) pressure is followed by a shear test at constant water content.

Confining Pressure (σ_3) - The isotropic chamber pressure applied to the soil specimen during consolidation and compression.

Maximum Deviator Stress ($\sigma_1-\sigma_3$) - The difference between the major and minor principal stresses in the specimen at failure. The major principal stress on the specimen is equal to the unit axial load plus the chamber pressure and the minor principal stress on the specimen is equal to the chamber pressure.

Strain Rate - Axial strain, ε, at a given stress level is defined as the ratio of the change in length (ΔL) of the specimen to the original length of the specimen (L_o). The rate of strain was controlled during the test so that this ratio increased at equal increments for each minute of testing.

Back Pressure - Pressure in excess of atmospheric applied to the pore water of a soil sample. Back pressure is usually applied to (1) increase saturation of the sample, or (2) simulate the actual in-situ pressure regime.

K. Unconfined Compression - Test procedures were as described in ASTM D 2166-66. Unconfined compressive strength is

defined as the load per unit area at which an unconfined prismatic or cylindrical specimen of soil will fail in a simple compression test. In these methods, unconfined compressive strength is taken as the maximum load attained per unit area or the load per unit area at 20 percent axial strain, whichever occurred first during the performance of a test.

L. Direct Shear - The procedures of ASTM D 3080-72 were followed for direct shear testing. In this test, soil under an applied normal load is stressed to failure by moving one section of the soil container (shear box) relative to the other section. Normal stress is the value of load per unit area acting perpendicular to the plane of shearing. Maximum shear strength is defined as the maximum resistance (ksf) of a soil to shearing (tangential) stresses.

M. Consolidation (ASTM D 2435-70) - A consolidation test is a test in which a cylindrical soil specimen is laterally confined in a ring and compressed between porous plates. The term "consolidation," as used here, indicates the gradual reduction in volume of the soil mass resulting from an increase in compressive stress (axial load per unit area).

N. Chemical - The chemical tests performed on soil samples included: pH; water soluble sodium, chloride, sulphate, calcium; and calcium carbonate content. pH is an index of

the acidity or alkalinity of a soil in terms of the logarithm of the reciprocal of the hydrogen ion concentration. ASTM test procedure designations for these chemical tests are included in the list on the first page of these Explanations.

O. CBR - California Bearing Ratio (CBR) is the ratio (in percent) of the resistance to penetration developed by a subgrade soil to that developed by a standard crushed-rock base material. The procedures for conducting a CBR test were as outlined in ASTM D 1883-73. The materials tested for CBR were also analyzed for particle-size distribution (ASTM D 422-63) and compaction characteristics (ASTM D 1557-70). The term "percentage of maximum density" indicates the ratio (as a percentage) of the compacted sample dry unit weight to maximum dry density obtained in the laboratory from ASTM D 1557-70, "Moisture-Density Relations of Soils Using 10-pound (4.5-kg) Hammer and 18-inch (457-mm) Drop."

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT													
				STANDARD SIEVE OPENING							U S STANDARD SIEVE NO.					PARTIC SIZE (	
				BLDRS.	COBBLES		GRAVEL				SAND				SILT OR CL		
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10	40	100	200	.005	
MS-B-1	P-1	0.8 - 1.6	0.24 - 0.49														
	P-1	1.6 - 2.4	0.49 - 0.73										100	97	93		
	P-2	3.0 - 3.8	0.91 - 1.16									100	97	93	85		
	D-3	6.8 - 7.3	2.07 - 2.23					100	97	91	86	81	70	48	36		
	D-4	10.5 - 11.0	3.20 - 3.35														
	D-5	15.5 - 16.0	4.72 - 4.88							100	99	96	39	16	13		
	P-6	20.0 - 20.9	6.10 - 6.37									100	86	36	22		
	P-7	25.0 - 25.8	7.62 - 7.86														
	P-8	30.5 - 31.0	9.30 - 9.45														
	P-8	31.2 - 31.7	9.51 - 9.66														
	P-8	31.9 - 32.4	9.72 - 9.86						100	99	95	86	68	37	22		
	P-9	40.0 - 40.6	12.19 - 12.37														
	P-10	50.0 - 52.4	15.24 - 15.97								100	98	79	58	51		
	P-11	60.8 - 61.6	18.53 - 18.78								100	88	35	15	11		
	P-12	70.8 - 71.6	21.58 - 21.82														
	P-13	80.0 - 80.9	24.38 - 24.66						100	99	96	90	42	15	10		
	P-14	90.8 - 91.2	27.68 - 27.80								100	97	65	41	29		
	P-15	98.8 - 99.6	30.11 - 30.36								100	97	74	48	34		
MS-B-2	P-1	0.8 - 1.7	0.24 - 0.52					100	93	90	82	75	65	50	38		
	D-3	5.5 - 6.0	1.68 - 1.83														
	D-4	8.5 - 9.0	2.59 - 2.74														
	D-5	11.0 - 11.5	3.35 - 3.51					100	94	75	55	36	13	8	6		
	D-6	15.5 - 16.0	4.72 - 4.88							100	99	97	91	75	58		
	D-6	15.5 - 16.0	4.72 - 4.88														
	D-7	20.5 - 21.0	6.25 - 6.40														
	D-8	25.3 - 25.8	7.71 - 7.86					100	95	73	50	35	23	14	11		
	D-9	31.0 - 31.5	9.45 - 9.60							100	90	61	19	5	3		
	D-10	40.2 - 40.7	12.25 - 12.41				100	75	57	43	3	24	11	6	5		
	D-11	50.2 - 50.7	15.30 - 15.45														
	D-12	60.2 - 60.7	18.35 - 18.50								100	98	62	31	21		
	D-13	70.3 - 70.8	21.43 - 21.58						100	89	76	58	22	12	8		
	D-14	80.2 - 80.7	24.44 - 24.60														
	D-15	90.3 - 90.8	27.52 - 27.68						100	96	83	75	49	28	17		
	D-16	99.2 - 99.7	30.24 - 30.39								100	96	72	37	18		
MS-B-3	D-1	1.0 - 1.5	0.30 - 0.46						100	93	84	69	35	18	13		
	D-2	3.5 - 4.0	1.07 - 1.22							100	96	62	16	6	3		
	D-3	6.0 - 6.5	1.83 - 1.98														
	D-4	8.5 - 9.0	2.59 - 2.74														
	D-5	10.5 - 11.0	3.20 - 3.35					100	92	91	89	81	48	29	24		
	D-6	15.3 - 15.8	4.66 - 4.82														
	D-7	21.0 - 21.5	6.40 - 6.55						100	99	96	88	27	9	7		

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

RD SIEVE NO.			PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION
			SILT OR CLAY						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)					
40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)						
								CL	73.3	1174	10.4	21.9	1.26								
00	97	93			33	18	15	CL	72.6	1163	10.7	22.2	1.28				2.65		•		
97	93	85			31	20	11	CL	75.4	1208	11.4	24.8	1.24								
70	48	36					NP	SM	97.3	1559	7.3	26.9	0.73								
								SM	108.1	1732	7.2	34.7	0.56								
39	16	13					NP	SM	106.9	1712	8.2	37.1	0.61				2.76			•	
86	36	22						SM	88.9	1424	13.6	41.0	0.90								
								SM	109.7	1757	9.9	49.8	0.54								
								SM	103.6	1660	12.4	53.5	0.63					•			
								SM	103.8	1663	10.5	45.5	0.62					•			
68	37	22			22	19	3	SM	106.7	1709	10.0	46.4	0.58					•			
								SM	111.1	1780	9.2	48.2	0.52								
79	58	51					NP	ML	96.7	1549	19.3	70.1	0.74								
35	15	11						SW-SM	111.0	1778	11.7	61.2	0.52								
								SM	111.1	1780	11.8	61.8	0.52								
42	15	10						SW-SM	117.7	1885	15.6	97.9	0.43								
65	41	29						SM	121.1	1940	7.6	52.8	0.39								
74	48	34						SM	103.4	1656	17.8	76.3	0.63								
65	50	38					NP	SM	105.4	1688	3.4	15.4	0.60								
								SM	102.0	1634	5.1	21.0	0.65								
							NP	SM	103.3	1655	5.5	23.3	0.63								
13	8	6					NP	SW-SM	114.5	1834	6.7	38.1	0.47								
91	75	58					NP	ML	96.1	1540	6.8	24.4	0.75								
								ML	91.8	1471	8.8	28.4	0.84								•
								SM	102.3	1639	9.9	41.6	0.65								
23	14	11						GP-GM	115.4	1849	12.4	72.6	0.46								
19	5	3						SW	112.8	1807	8.7	47.5	0.49								
11	6	5						GW-GM	120.1	1924	10.8	72.5	0.40								
								SM	100.1	1603	13.8	54.5	0.68								
62	31	21						SM	101.2	1621	12.0	48.6	0.67								
22	12	8						SW-SM	119.3	1911	9.5	62.6	0.41								
								SM	99.8	1599	19.0	74.5	0.69								
49	28	17					NP	SM	104.9	1680	22.0	97.9	0.61								
72	37	18						SM	96.8	1551	26.9	97.9	0.74								
35	18	13					NP	SM	100.9	1616	9.1	36.6	0.67								
16	6	3						SW	104.5	1674	4.2	18.5	0.61								
								SW	90.7	1453	11.7	36.7	0.86								
								SW	117.8	1887	6.2	39.2	0.43								
48	29	24			31	18	13	SC	104.8	1679	13.6	60.6	0.61								
								SM	115.3	1847	8.3	48.3	0.46								
27	9	7						SP-SM	105.6	1692	7.8	35.5	0.60							•	

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SUMMARY OF LABC
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	SATURATION (%)	VOID RATIO	COMPACTED MAXIMUM DRY DENSITY (pcf)	COMPACTED MAXIMUM DRY DENSITY (kg/m^3)	OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
	21.9	1.26										
	22.2	1.28				2.65		*				
	24.8	1.24										
	26.9	0.73										
	34.7	0.56										
	37.1	0.61				2.76			*			
	41.0	0.90									*	
	49.8	0.54										
	53.5	0.63					*					
5	45.5	0.62					*					
0	46.4	0.58					*					
	48.2	0.52										
3	70.1	0.74										
7	61.2	0.52										
3	61.8	0.52										
6	97.9	0.43										
	52.8	0.39										
8	76.3	0.63										
4	15.4	0.60										
1	21.0	0.65									*	
5	23.3	0.63										
7	38.1	0.47										
8	24.4	0.75										
8	28.4	0.84								*		
9	41.6	0.65										
.4	72.6	0.46										
7	47.5	0.49										
.8	72.5	0.40										
.8	54.5	0.68										
.0	48.6	0.67										
.5	62.6	0.41										
.0	74.5	0.69										
.0	97.9	0.61										
.9	97.9	0.74										
.1	36.6	0.67										
.2	18.5	0.61										
.7	36.7	0.86										
.2	39.2	0.43										
.6	60.6	0.61										
.3	48.3	0.46										
.8	35.5	0.60							*			

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SUMMARY OF LABORATORY RESULTS
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TABLE II-1

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT													
				STANDARD SIEVE OPENING							U S STANDARD SIEVE NO.						PI SI
				BLDRS.	COBBLES		GRAVEL				SAND				SILT OI		
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10	40	100	200	.0(	
MS-B-3	D-8	25.2 - 25.7	7.68 - 7.83						100	97	94	88	64	37	25		
	D-9	30.2 - 30.7	9.20 - 9.36					100	99	93	85	70	36	19	13		
	D-10	40.5 - 41.0	12.34 - 12.50							100	97	89	57	28	18		
	P-11	50.8 - 51.6	15.24 - 15.48						100	91	77	66	38	18	12		
	P-12	60.2 - 60.7	18.35 - 18.50														
	P-12	60.2 - 60.7	18.35 - 18.50														
	P-12	61.0 - 61.5	18.59 - 18.75														
	P-12	61.8 - 62.3	18.84 - 18.99								100	99	88	62	40	1	
	P-13	70.7 - 70.7	21.34 - 21.55								100	94	69	42	26		
	P-14	86.8 - 87.6	26.46 - 26.70														
	P-15	98.8 - 99.8	30.11 - 30.42								100	84	30	14	10		
MS-T-1	B-1	0.5 - 2.0	0.15 - 0.61						100	98	98	96	89	81	72		
MS-T-2	B-1	0.5 - 2.0	0.15 - 0.61								100	95	65	39	31		
	b-2	5.0 - 6.0	1.52 - 1.83							100	99	90	61	40	31		
MS-T-3	B-1	0.5 - 2.0	0.15 - 0.61									100	99	97	94	1	
	b-2	7.0 - 8.0	2.13 - 2.44									100	96	77	59		
	b-3	12.0 - 13.0	3.66 - 3.96						100	91	83	61	24	13	10		
MS-T-5	B-1	0.5 - 2.0	0.15 - 0.61					100	87	77	67	53	23	11	8		
MS-T-6	B-1	0.5 - 2.0	0.15 - 0.61						100	91	81	71	58	40	30		
	b-2	10.0 - 11.0	3.05 - 3.35					100	98	90	79	62	19	9	7		
MS-T-7	B-1	0.5 - 2.0	0.15 - 0.61				100	92	81	62	44	33	23	17	14		
MS-T-8	B-1	0.5 - 2.0	0.15 - 0.61				100	95	73	66	57	49	40	34	31		
MS-P-2	b-1	0.5 - 2.0	0.15 - 0.61														
MS-P-4	b-1	0.5 - 2.0	0.15 - 0.61					100	92	85	72	49	15	6	5		
MS-P-7	b-1	0.5 - 2.0	0.15 - 0.61							100	99	97	85	69	58		
MS-P-9	B-1	0.5 - 2.0	0.15 - 0.61				100	90	68	56	40	28	18	11	9		
MS-CS-5	b-1	0.0 - 0.5	0.00 - 0.30				100	85	67	60	54	49	46	42	35		
MS-CS-12	b-1	0.5 - 2.0	0.15 - 0.61						100	77	62	51	41	35	31		
MS-CS-20	b-1	0.5 - 2.0	0.15 - 0.61									100	99	92	82		

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

GHT																						
TANDARD SIEVE NO.				PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT
SAND			SILT OR CLAY							DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)				
0	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)					
8	64	37	25					NP	SM	111.3	1783	12.8	67.6	0.51							
0	36	19	13						SM	113.8	1823	11.0	61.7	0.48						•	
9	57	28	18					NP	SM	106.3	1703	11.3	51.9	0.59							
6	38	18	12						SW-SM	108.0	1730	11.9	57.1	0.56							
									SM	91.7	1469	15.3	49.3	0.84							
									SM	92.9	1488	4.2	13.8	0.81					•		
									SM	88.4	1416	13.5	40.2	0.91					•		
9	88	62	40	11	6			NP	SM	93.6	1499	13.0	43.8	0.80					•		
4	69	42	26						SM	111.7	1789	8.4	44.8	0.51							
								NP	SW-SM	106.7	1709	16.2	75.4	0.58							
4	30	14	10						SW-SM	105.2	1685	15.6	70.1	0.60							
9	89	81	72			25	21	4	CL-ML						114.0	1826	15.0	2.68			
5	65	39	31			30	16	14	SC												
0	61	40	31					NP	SM												
0	99	97	94	17	7	31	20	11	CL												
0	96	77	59					NP	ML												
1	24	13	10						SW-SM												
3	23	11	8						SW-SM						126.0	2018	9.4				
	58	40	30						SM												
2	19	9	7						SW-SM												
3	23	17	14						GM						131.5	2106	9.0	2.66			
2	40	34	31			32	21	11	GC						119.0	1906	12.5				
								NP	ML												
9	15	6	5						SW-SM												
7	85	69	58					NP	ML												
3	18	11	9						GP-GM												
9	46	42	35			33	21	12	GC												
	41	35	31						GM												
0	99	92	82					NP	ML												

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SUMMARY OF
MULESHO
P

30 JUN 81

2

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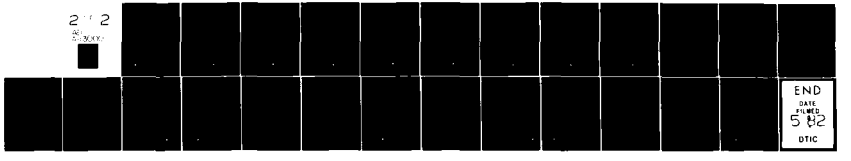
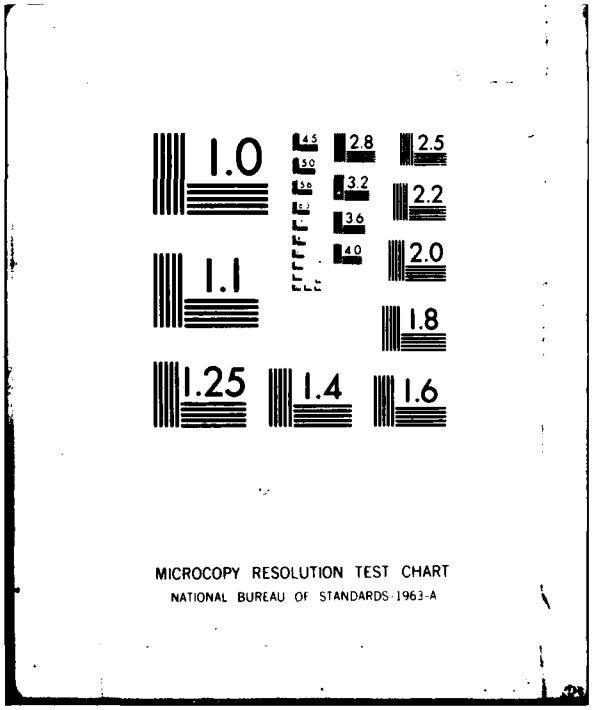
JUN 81
UNCLASSIFIED E-TR-27-MS-2 F04704-80-C-0006
NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

RATIO	COMPACTED: MAXIMUM DRY DENSITY (pcf)	COMPACTED: MAXIMUM DRY DENSITY (kg/m^3)	COMPACTED: OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
.51										
.48						•			•	
.59										
.56										
.84										
.81					•					
.91					•					
.80					•					
.51										
.58										
.60									•	
	114.0	1826	15.0	2.68						•
	126.0	2018	9.4							•
	131.5	2106	9.0	2.66						•
	119.0	1906	12.5							•
									•	

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MX SITING INVESTIGATION
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SUMMARY OF LABORATORY RESULTS
MULESHOE VALLEY, NEVADA
PAGE 2 OF 2

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30 JUN 81

TABLE B2-1

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	TYPE OF TEST	DRY DENSITY		MOISTURE CONTENT (%)	CONFINING PRESSURE (σ_3)		MAXIMUM DEVIATOR STRESS ($\sigma_1 - \sigma_3$)		STRAIN RATE (%/min)	BACK PRESSURE	
		FEET	METERS			pcf	kg/m³		ksf	kN/m²	ksf	kN/m²		ksf	kN/m²
MS-B-1	P-8	31.2 - 31.7	9.51 - 9.66	SM	CD	103.8	1663	10.5	3.0	144	10.0	480	0.04	0	0
	P-8	30.5 - 31.0	9.30 - 9.45	SM	CD	103.6	1660	12.4	4.5	216	15.5	744	0.04	0	0
	P-8	31.9 - 32.4	9.72 - 9.88	SM	CD	106.7	1709	10.0	6.0	288	21.2	1018	0.04	0	0
MS-B-3	P-12	60.2 - 60.7	18.35 - 18.50	SM	CD	92.9	1488	4.2	6.0	288	24.8	1190	0.02	0	0
	P-12	61.8 - 62.3	18.84 - 18.99	SM	CD	93.6	1499	13.0	9.0	432	35.6	1709	0.02	0	0
	P-12	61.0 - 61.5	18.59 - 18.75	SM	CD	88.4	1416	13.5	12.0	575	44.1	2117	0.01	0	0

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SUMMARY OF TRIAXIAL COMPRESSION
TEST RESULTS
MULESHOE VALLEY, NEVADA

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TABLE II-8-2

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL FEET	SAMPLE INTERVAL METERS	SOIL TYPE	UNCONFINED COMP. STRENGTH ksf	UNCONFINED COMP. STRENGTH kN/m²	DRY DENSITY pcf	DRY DENSITY kg/m³	MOISTURE CONTENT (%)	DEGREE OF SATURATION (%)	HEIGHT/DIAMETER
MS-B-1	P-1	1.6 - 2.4	0.49 - 0.73	CL	2.5	118	72.6	1163	10.7	22.2	2.09
MS-B-3	D-9	30.2 - 30.7	9.20 - 9.36	SM	1.9	92	113.8	1823	11.0	61.7	2.00

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SUMMARY OF UNCONFINED COMPRESSION TEST RESULTS MULESHOE VALLEY, NEVADA

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TABLE II-9-3

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	NORMAL STRESS		MAXIMUM SHEAR STRENGTH	
		FEET	METERS		ksf	kN/m^2	ksf	kN/m^2
MS-B-1	D-5	15.5 - 16.0	4.72 - 4.88	SM	1.5	72	1.80	86
					2.3	108	2.43	116
					3.0	144	2.98	143
MS-B-3	D-7	21.0 - 21.5	6.40 - 6.55	SP-SM	2.0	96	2.56	123
					3.0	144	3.26	156
					4.0	192	4.91	235

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SUMMARY OF DIRECT SHEAR TEST RESULTS
MULESHOE VALLEY, NEVADA

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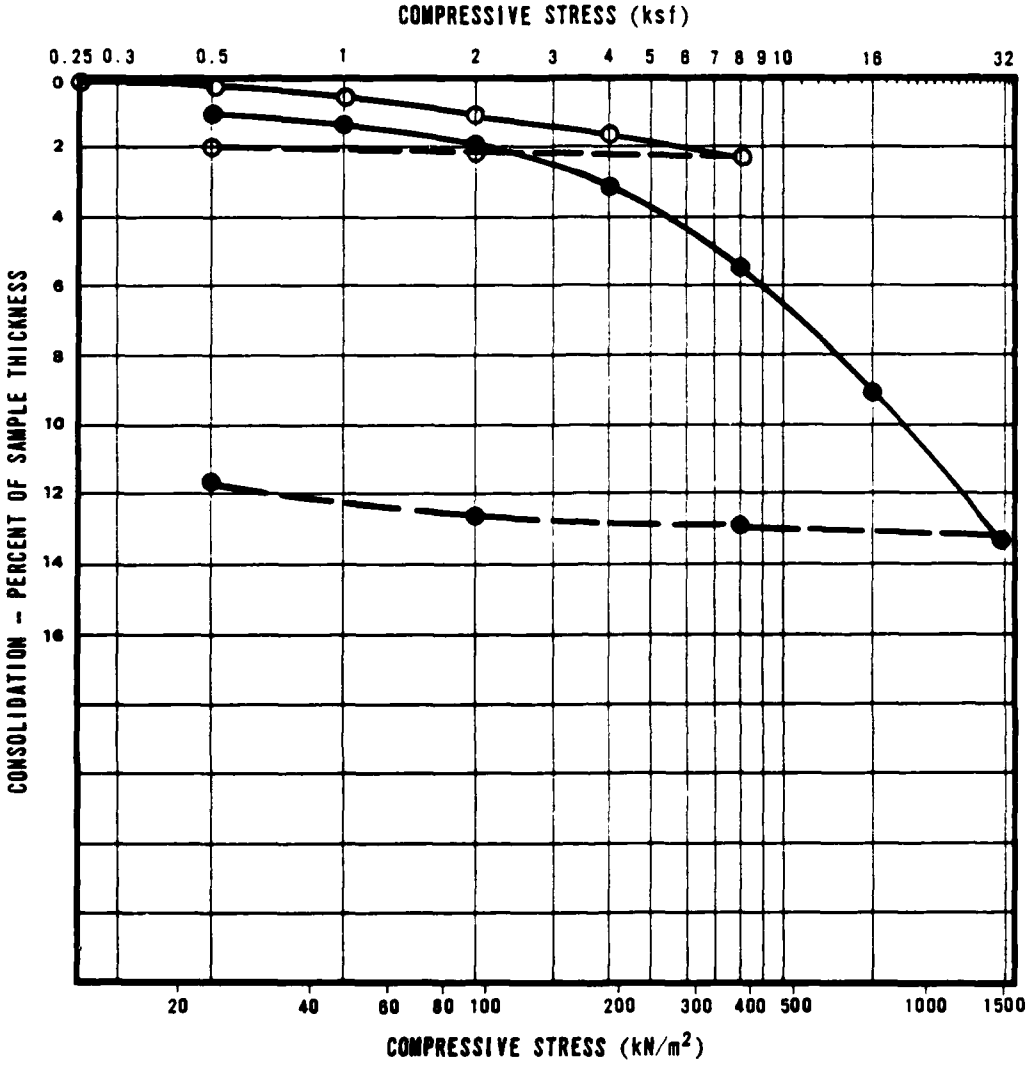
TABLE II-B-4



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
O	MS-B-2	D-6	15.5 - 16.0	4.72 - 4.88	ML	91.8	1471	8.8	0.84	28.4

O AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

– – – REBOUND

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CONSOLIDATION TEST RESULTS
MULESHOE VALLEY, NEVADA

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FIGURE II-6-1

ACTIVITY NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	pH	WATER SOLUBLE				CALCIUM CARBONATE
		FEET	METERS			SODIUM mg/kg	CHLORIDE mg/kg	SULPHATE mg/kg	CALCIUM mg/kg	mg/kg
MS-B-1	P-6	20.0 - 20.9	6.10 - 6.37	SM	8.2	42	21	2	53	193
MS-B-2	D-3	5.5 - 6.0	1.68 - 1.83	SM	9.0	76	10	3	61	158
MS-B-3	D-9	30.2 - 30.7	9.20 - 9.36	SM	8.4	20	70	4	81	317
MS-B-3	P-15	98.8 - 99.8	30.11 - 30.42	SW-SM	8.4	21	< 6	< 1	118	180
MS-P-2	b-1	0.5 - 2.0	0.15 - 0.61	ML	8.0	3	5	< 1	149	503

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SUMMARY OF CHEMICAL TEST RESULTS
MULESHOE VALLEY, NEVADA

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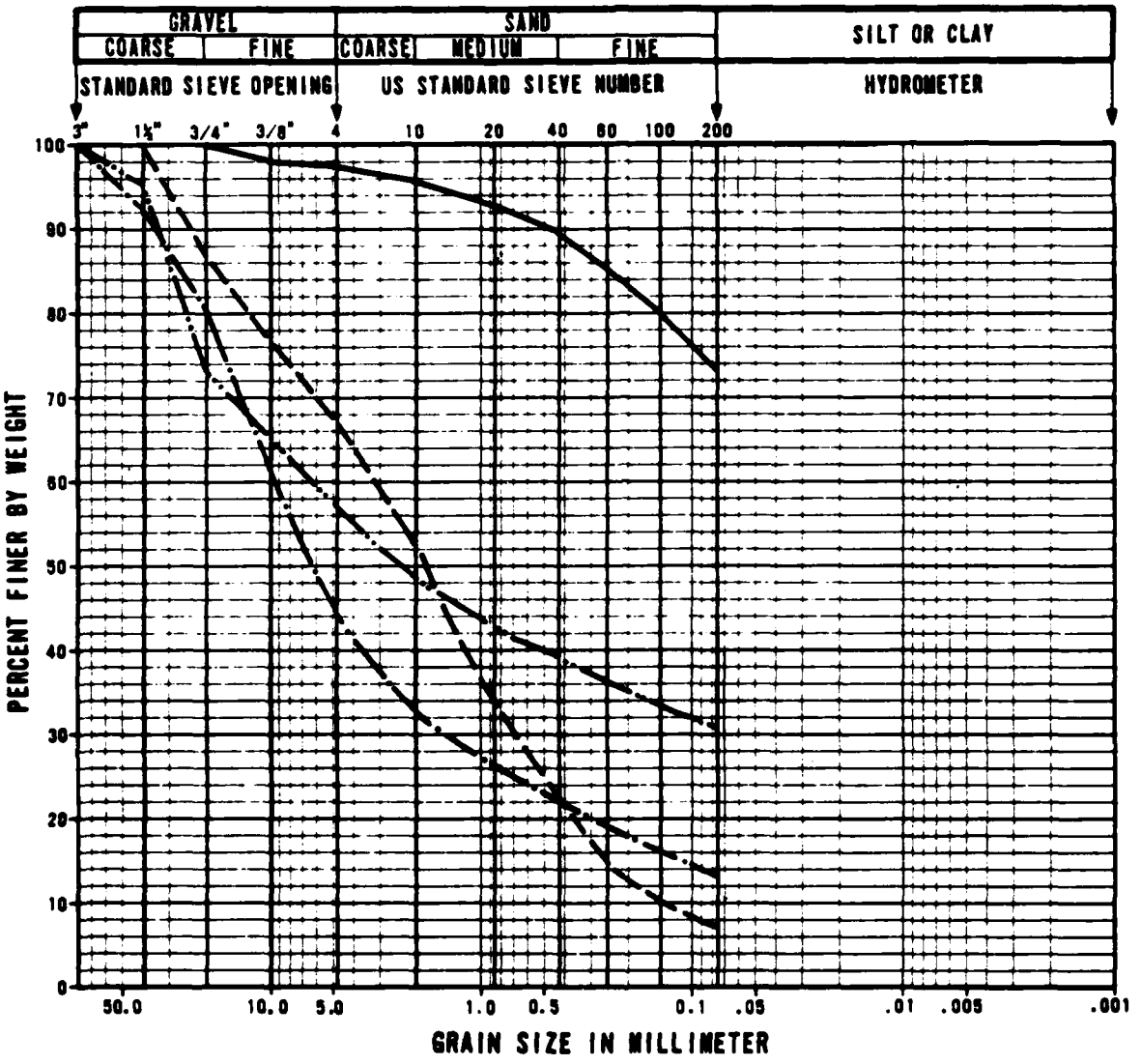
TABLE II-9-6



SYMBOL	COMPOSITE SAMPLE NUMBER	ACTIVITY NUMBER	SAMPLE INTERVAL		SOIL TYPE
			FEET	METERS	
———	A	MS-T-1	0.5 - 2.0	0.15 - 0.61	CL-ML
— —	B	MS-T-5	0.5 - 2.0	0.15 - 0.61	SW-SM
—·—	C	MS-T-7	0.5 - 2.0	0.15 - 0.61	GM
—··—	D	MS-T-8	0.5 - 2.0	0.15 - 0.61	GC

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GRAIN SIZE CURVES, CBR TESTS
MULESHOE VALLEY, NEVADA

30 JUN 81

FIGURE II-9-2

COMPOSITE SAMPLE NUMBER	SOIL TYPE	PERCENT PASSING #200	ATTERBERG LIMITS		SPECIFIC GRAVITY	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	COMPACTED DRY DENSITY		COMPACTED MOISTURE (%)	PERCENT OF MAXIMUM DRY DENSITY	CBR (%)
			LL	PI		pcf	kg/m³		pcf	kg/m³			
A	CL-ML	72	25	4	2.68	114.0	1826	15.0	110.9	1777	15.1	97.3	21
									106.3	1703	15.1	93.3	7
									98.8	1582	15.2	86.7	4
B	SW-SM	8				126.0	2018	9.4	116.3	1863	9.3	92.3	80
									112.1	1796	9.1	89.0	49
C	GM	14			2.66	131.5	2106	9.0	121.2	1942	9.1	92.2	51
									115.8	1855	8.5	88.1	17
D	GC	31	32	11		119.0	1906	12.5	116.1	1859	14.6	97.5	80
									114.3	1831	13.7	96.0	61
									108.6	1740	12.3	91.3	21

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CALIFORNIA BEARING RATIO (CBR) TEST RESULTS MULESHOE VALLEY, NEVADA

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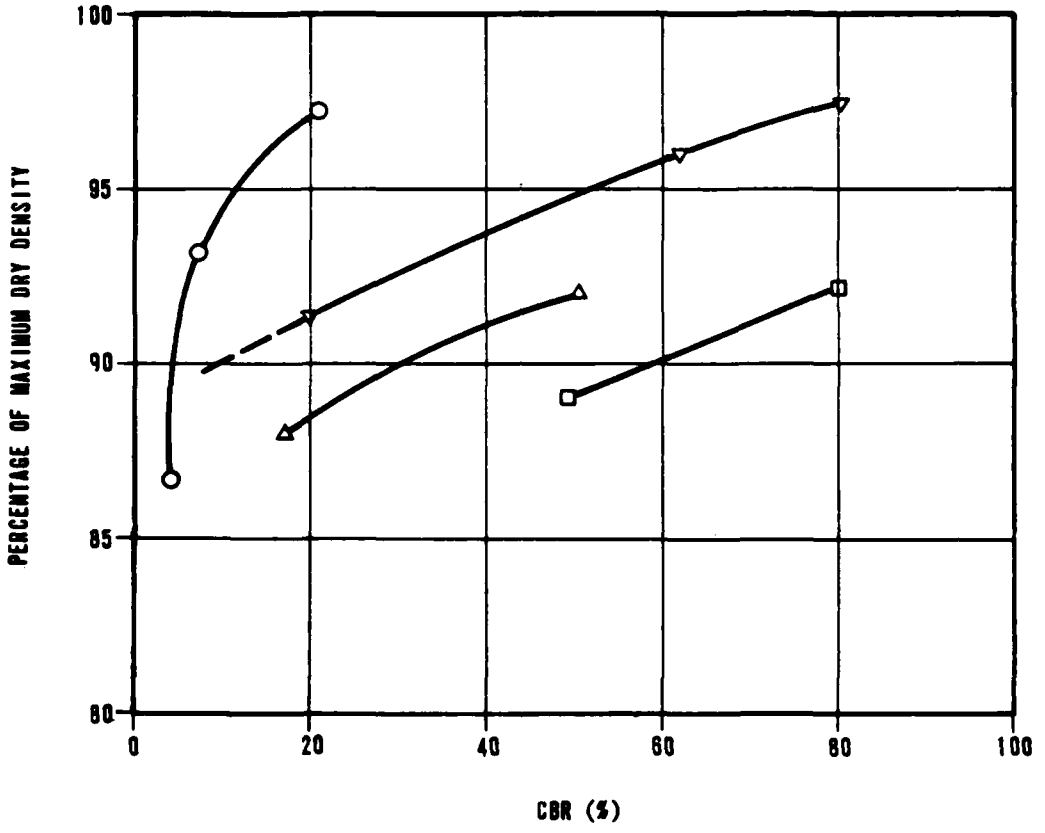
TABLE II-[illegible]



SYMBOL	COMPOSITE SAMPLE NUMBER	SOIL TYPE
A	○	CL-ML
B	□	SW-SM
C	△	GM
D	▽	GC

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CALIFORNIA BEARING RATIO
(CBR) CURVES
MULESHOE VALLEY, NEVADA

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FIGURE II-6-3

10.0 CONE PENETROMETER TEST RESULTS

Explanation: The results of all cone penetrometer tests are presented in this section. Explanations of the test results are as follows:

A. Depth - Corresponds to depth below ground surface.

B. Friction Resistance - The resistance to penetration developed by the friction sleeve, equal to the vertical force applied to the sleeve divided by its surface area. This resistance is the sum of friction and adhesion.

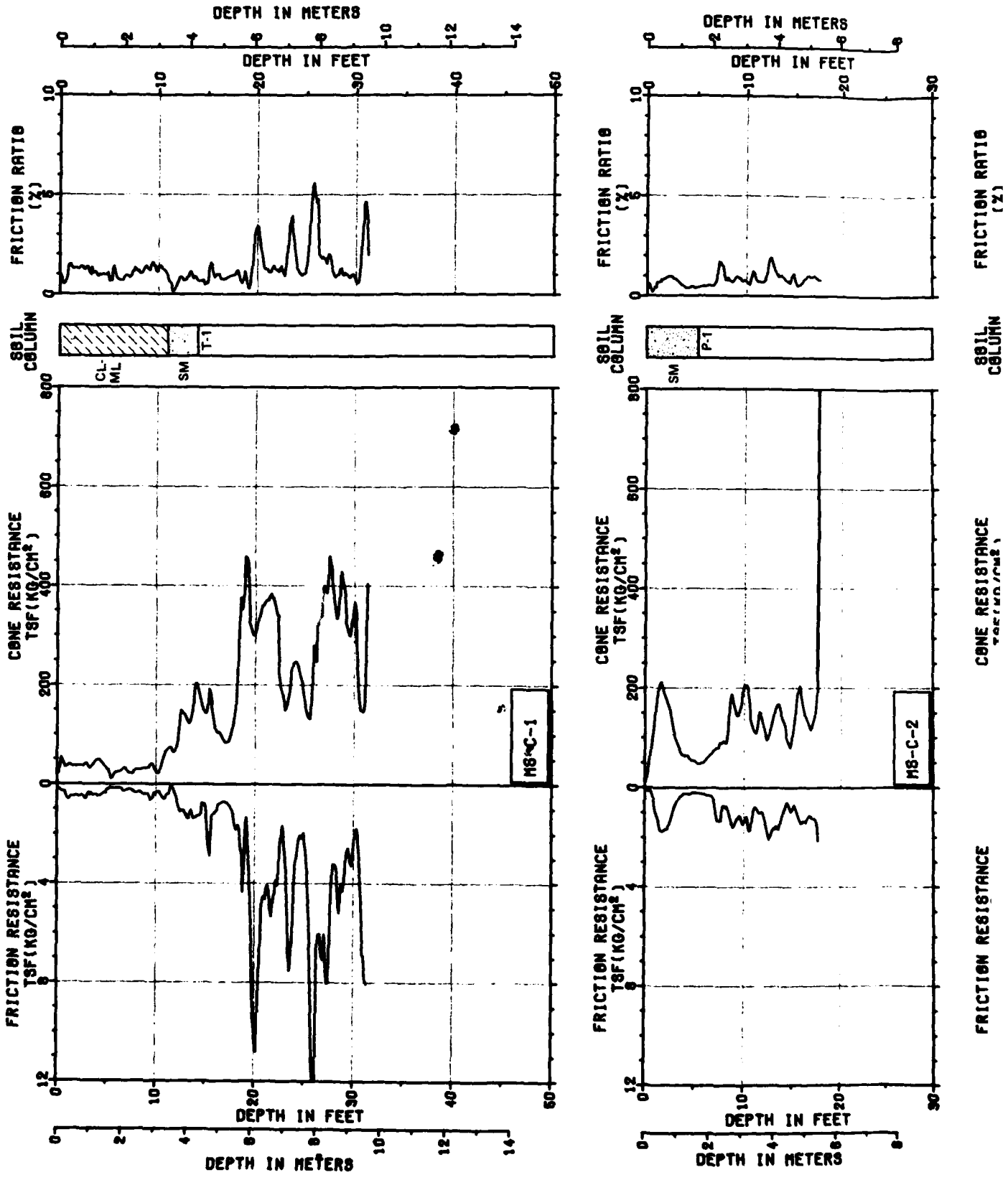
C. Cone Resistance - The resistance to penetration developed by the cone, equal to the vertical force applied to the cone divided by its horizontally projected area.

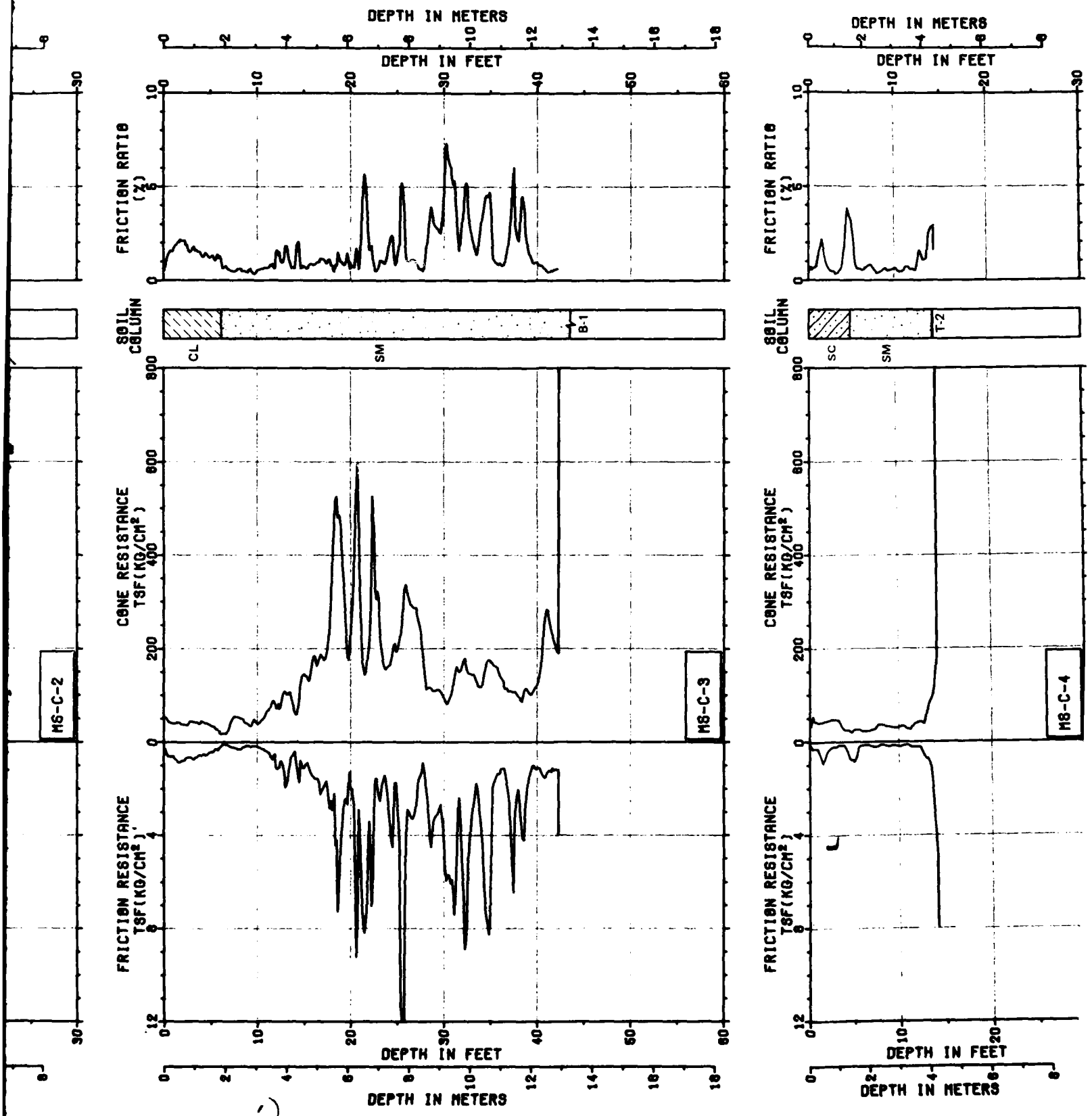
D. Friction Ratio - The ratio of friction resistance to cone resistance.

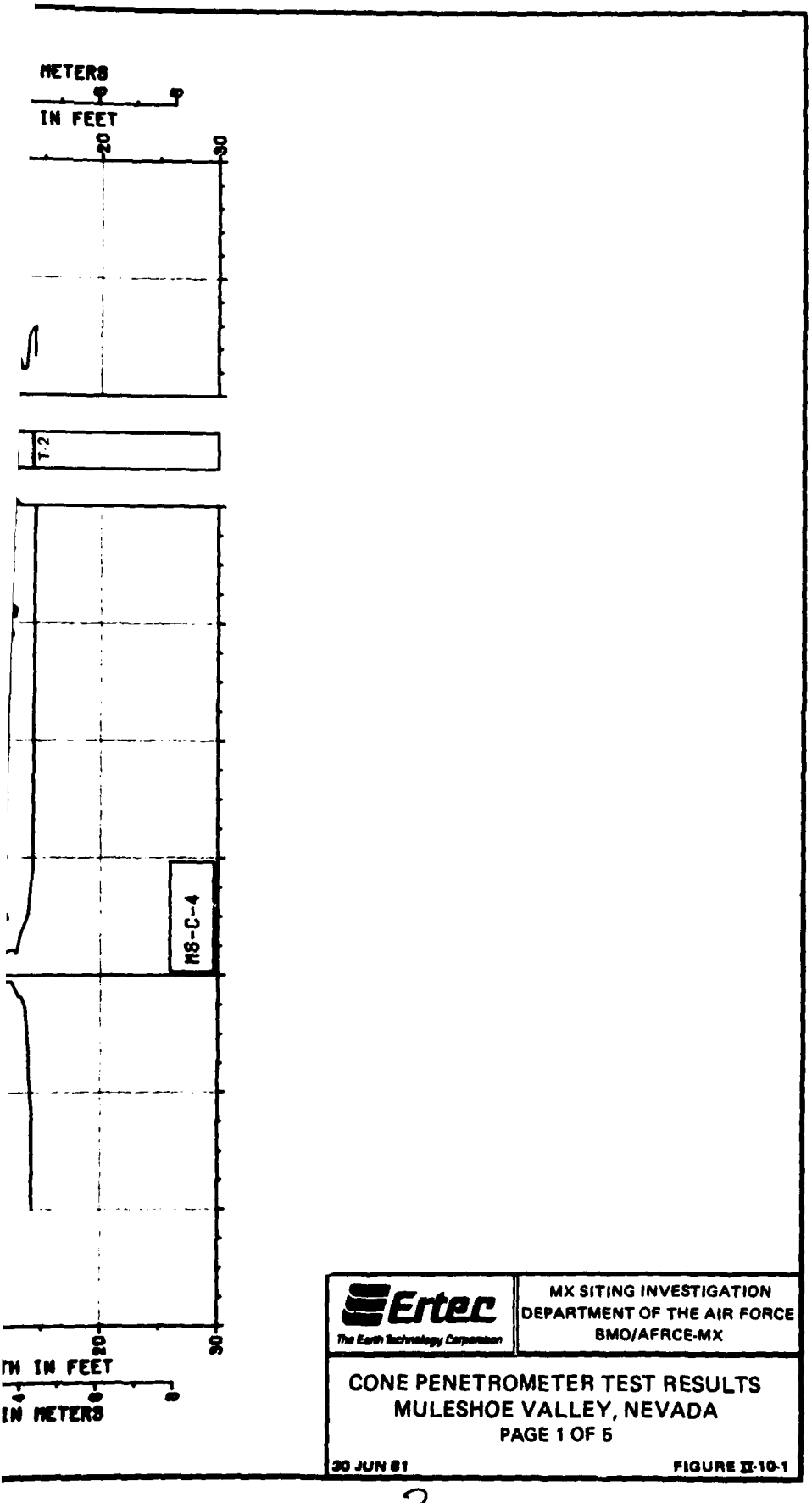
E. Designation - Each cone penetrometer test is identified by a number: for example C-1.

C - abbreviation for the CPT
1 - number of the test

F. Soil Column - A graphical presentation of the soil type versus depth at each cone penetrometer test location. The Unified Soil Classification Symbol (Table II-6-1) for each different soil type is listed immediately to the left of the soil column. Immediately below the soil column, the activity number for the corresponding boring, trench, test pit, or surficial soil sample at each CPT location is given.


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
CL-ML
SM
T-1
CONE RESISTANCE TSF(KG/CM²)
MS-C-1
FRICTION RESISTANCE TSF(KG/CM²)
DEPTH IN METERS
DEPTH IN FEET
DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
SM
P-1
CONE RESISTANCE TSF(KG/CM²)
MS-C-2
FRICTION RESISTANCE TSF(KG/CM²)
DEPTH IN FEET
DEPTH IN METERS


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
CL
SM
B-1
SC
T-2
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
MS-C-2
MS-C-3
MS-C-4



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CONE PENETROMETER TEST RESULTS
MULESHOE VALLEY, NEVADA
PAGE 1 OF 5

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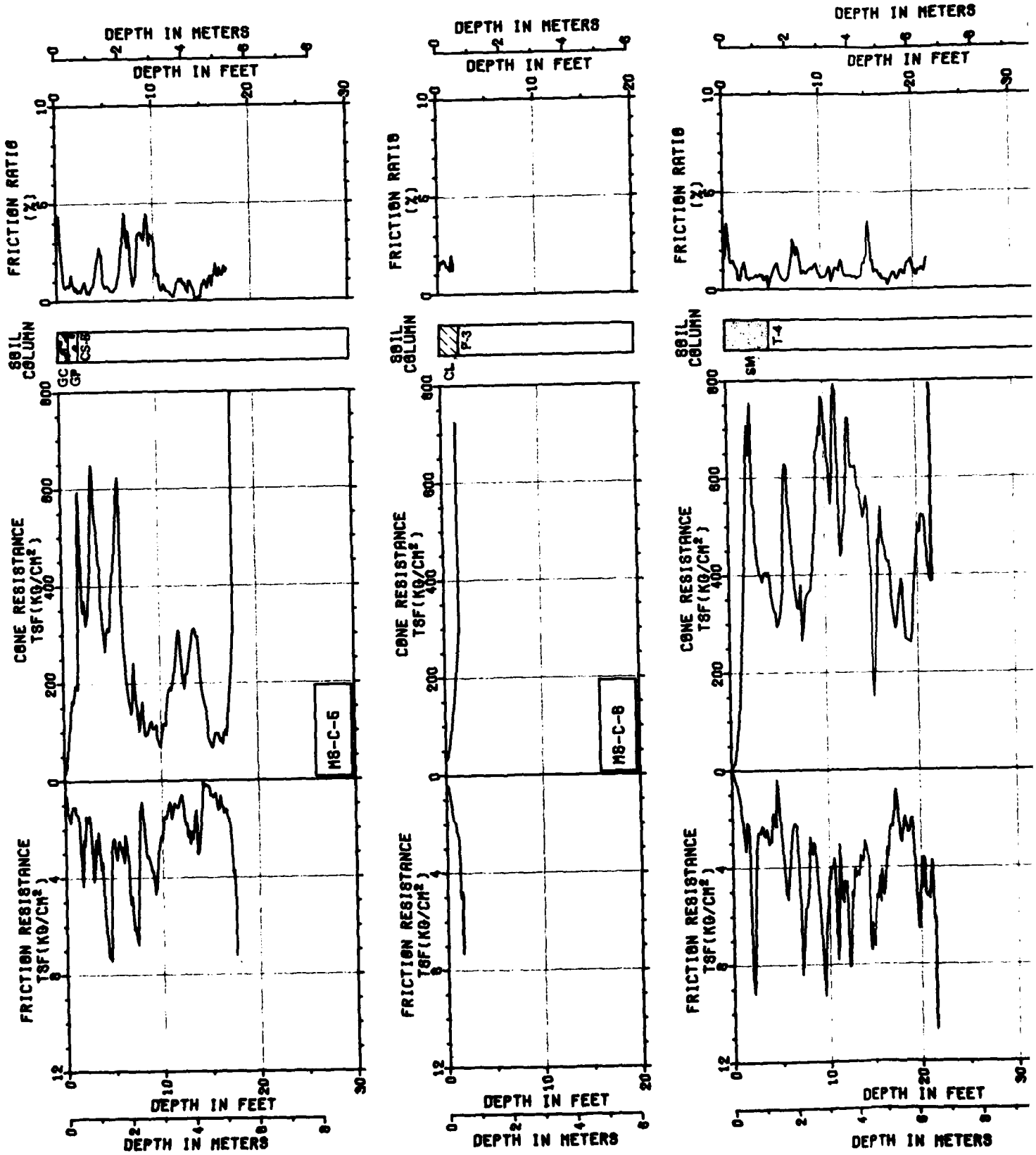
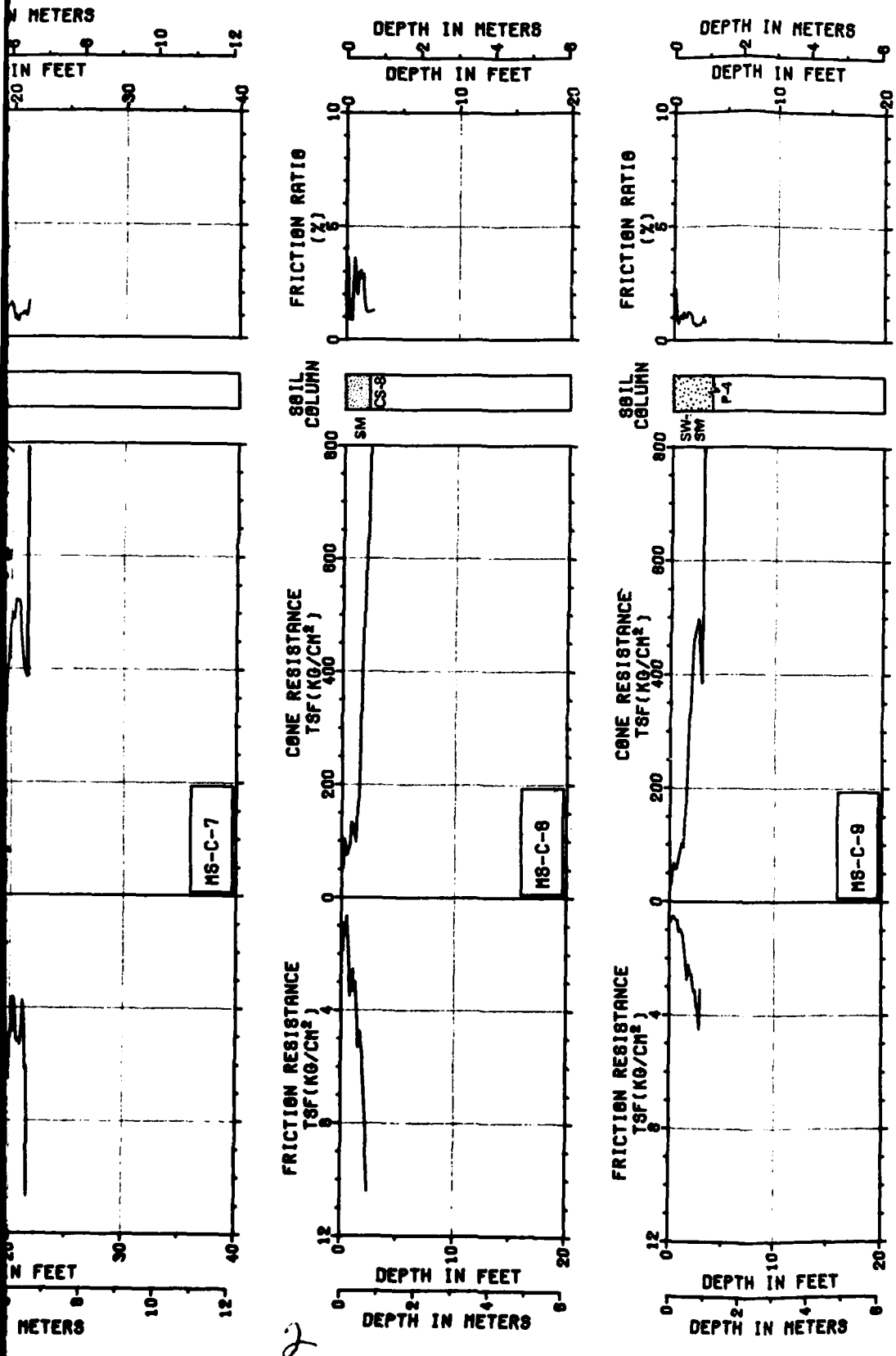
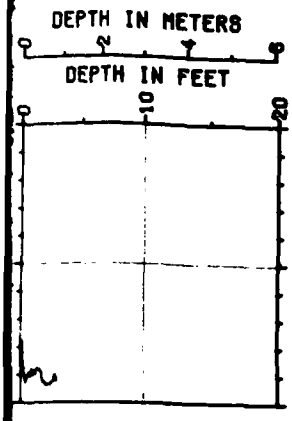
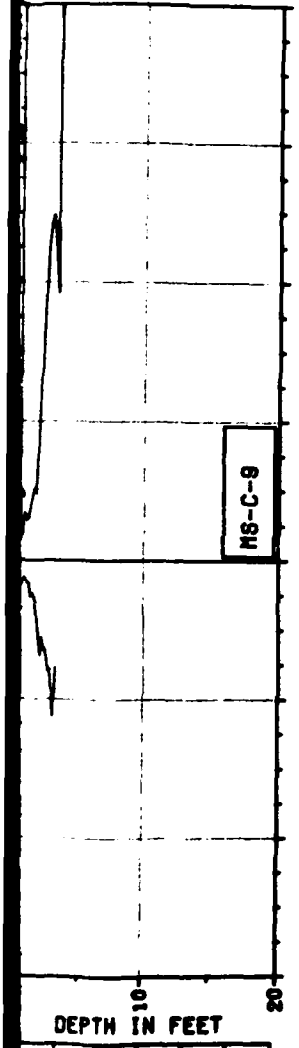
FIGURE II-10-1

3


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
GC
GP
CS-8
CL
P-3
SM
T-4
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
MS-C-5
MS-C-6


METERS
IN FEET
DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
CS-8
SM
P-4
SW-SM
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
MS-C-7
MS-C-8
MS-C-9





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CONE PENETROMETER TEST RESULTS
MULESHOE VALLEY, NEVADA
PAGE 2 OF 5

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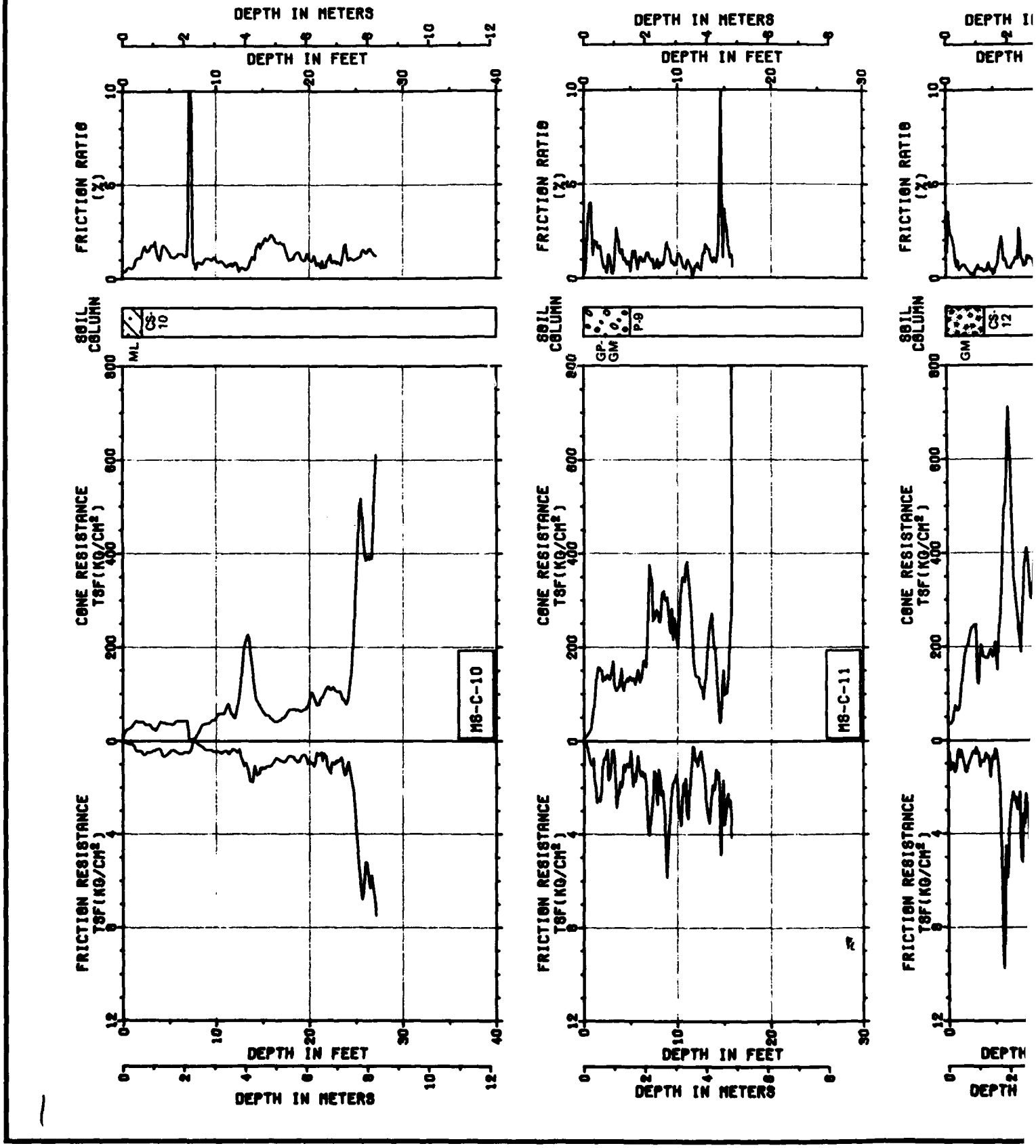
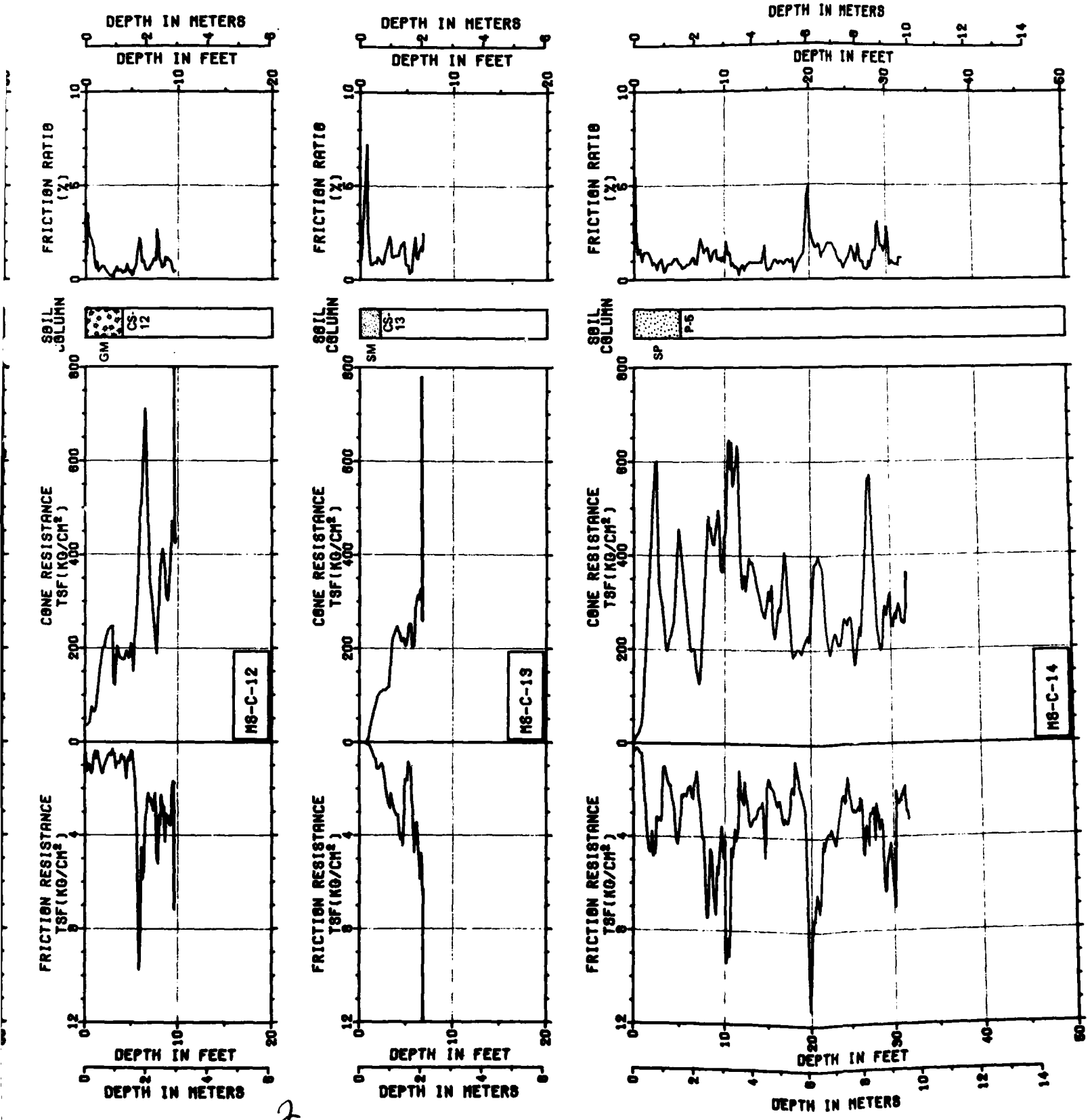
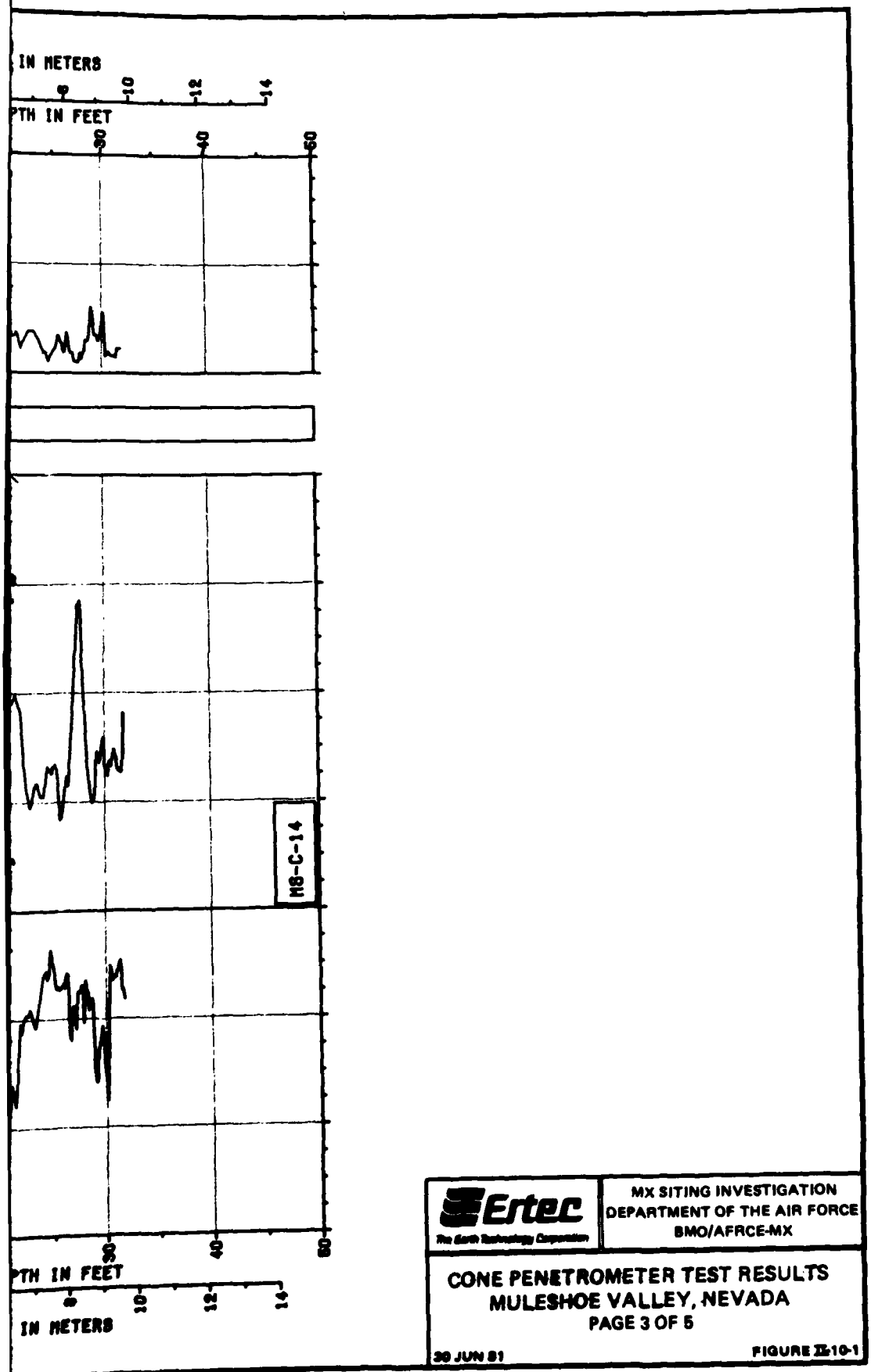
FIGURE II-10-1


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
ML
CS-10
GP-GM
P-8
GM
CS-12
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
MS-C-10
MS-C-11


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
GM
CS-12
SM
CS-13
SP
P-5
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
MS-C-12
MS-C-13
MS-C-14

2



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CONE PENETROMETER TEST RESULTS
MULESHOE VALLEY, NEVADA
PAGE 3 OF 5

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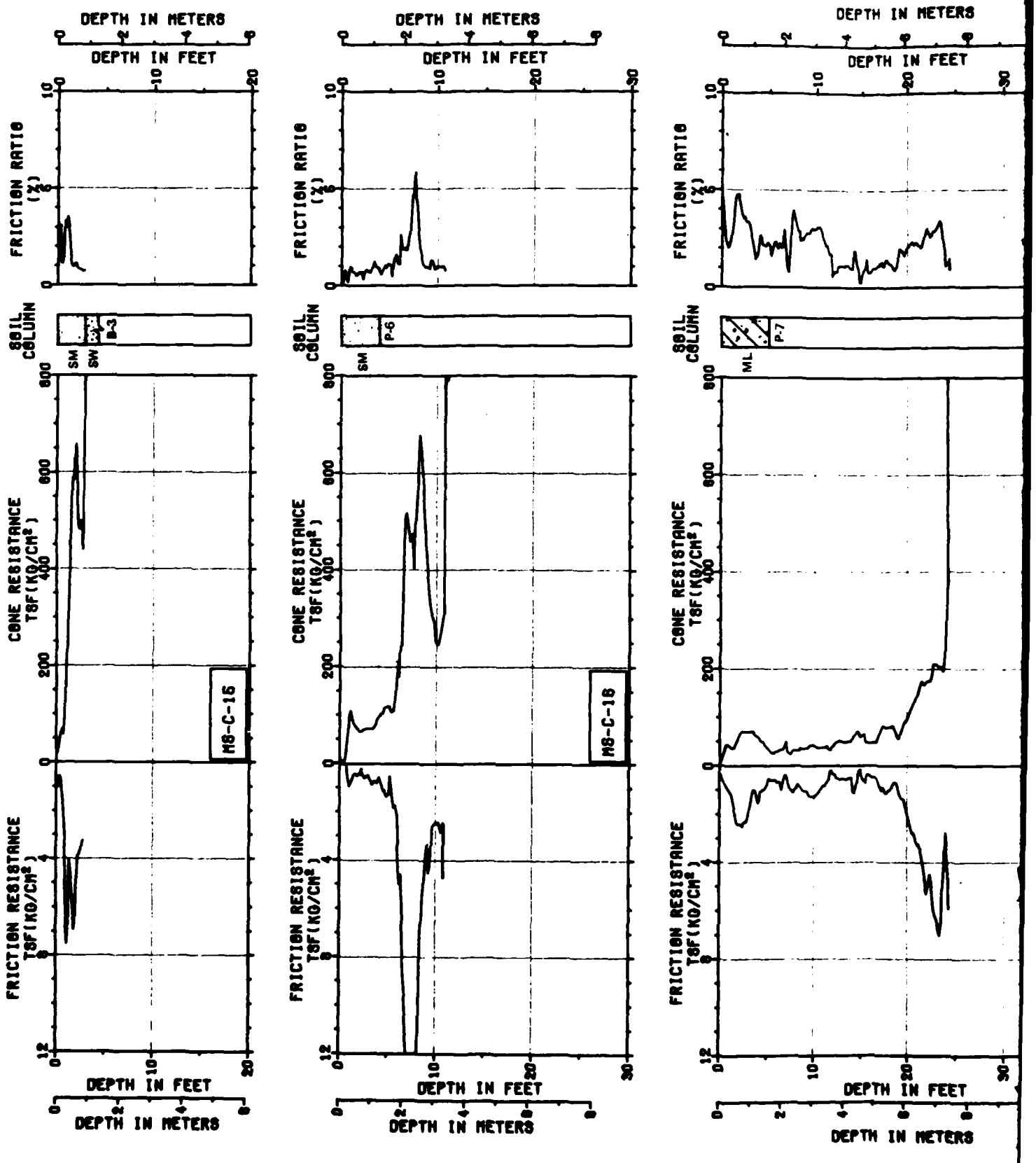
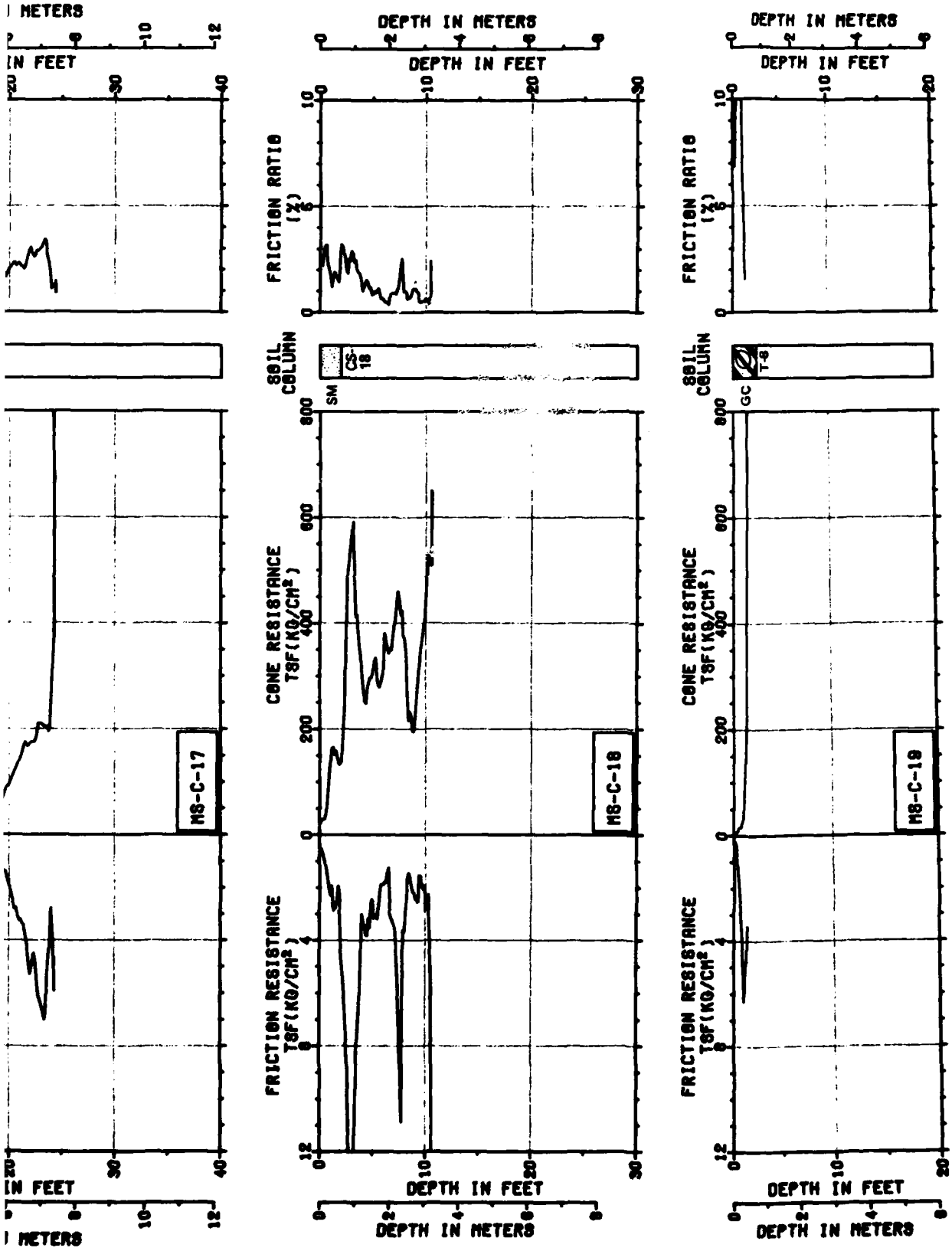
FIGURE III-10-1


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
SM
SW
B-3
CONE RESISTANCE TSF(KG/CM²)
MS-C-16
FRICTION RESISTANCE TSF(KG/CM²)
DEPTH IN METERS
DEPTH IN FEET
DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
SM
P-6
CONE RESISTANCE TSF(KG/CM²)
MS-C-18
FRICTION RESISTANCE TSF(KG/CM²)
DEPTH IN FEET
DEPTH IN METERS
DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
ML
P-7
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
DEPTH IN FEET
DEPTH IN METERS



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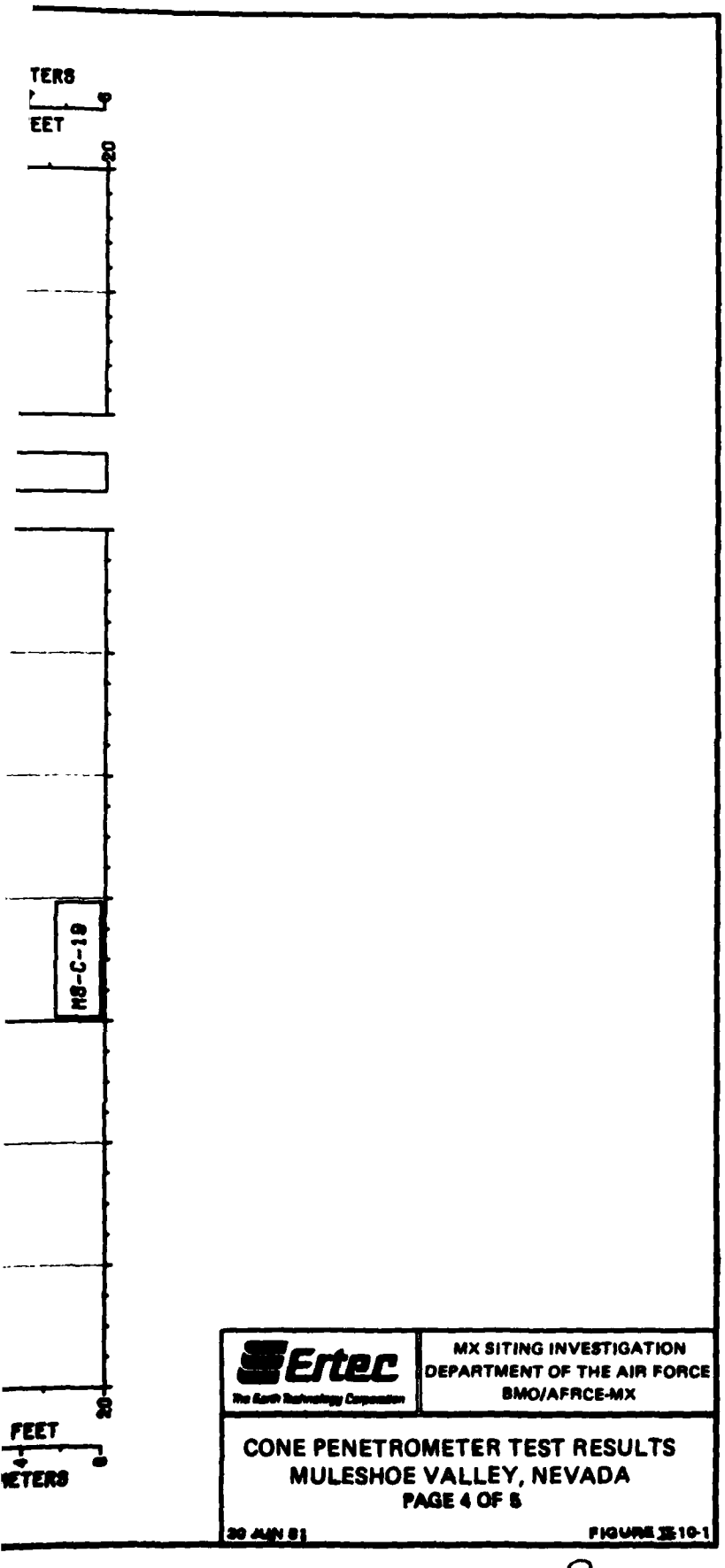

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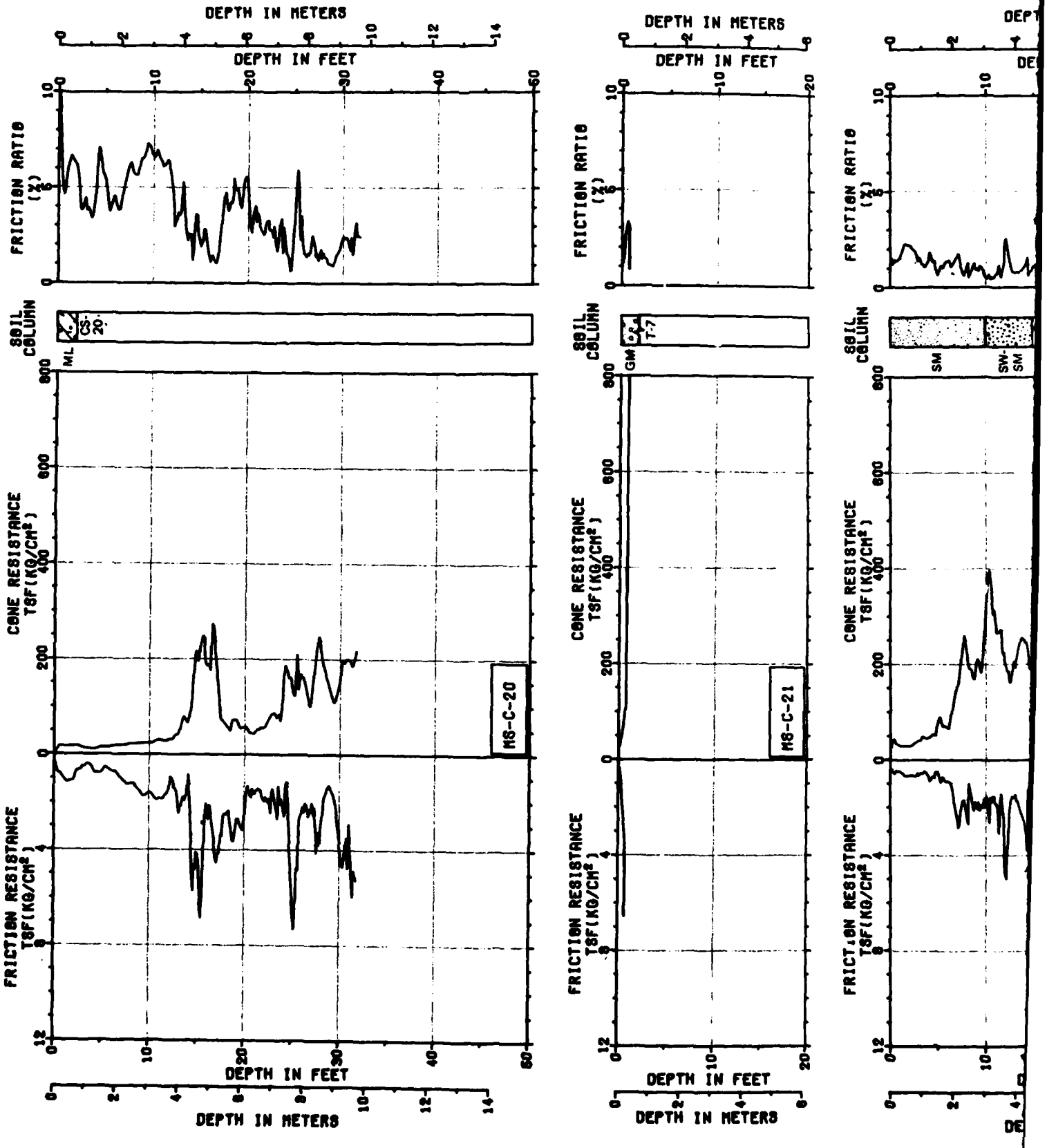
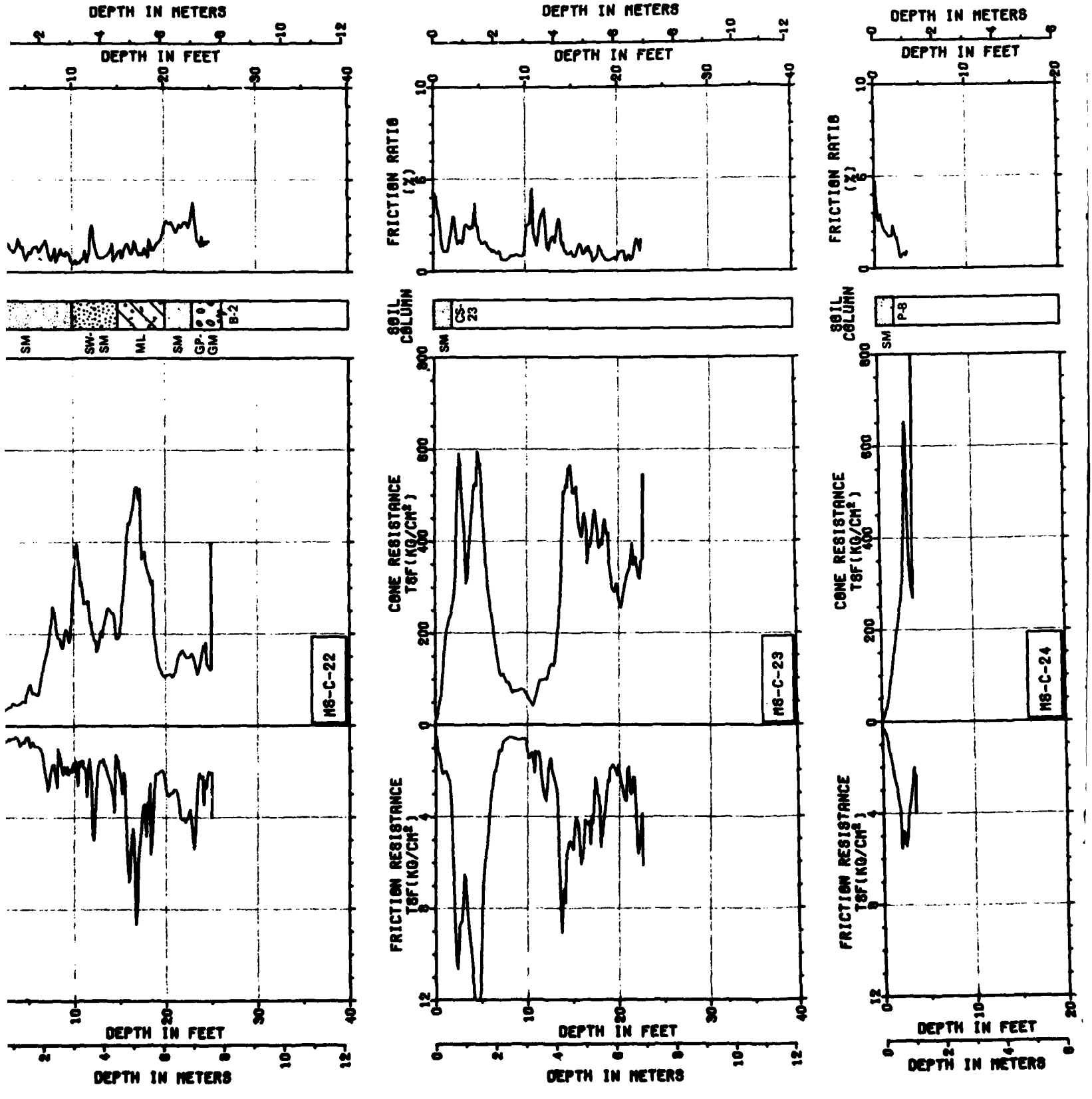
FIGURE 3.10-1


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
ML
CS-20
GM
T-7
SM
SW-SM
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
MS-C-20
MS-C-21


DEPTH IN METERS
DEPTH IN FEET
FRICTION RATIO (%)
SOIL COLUMN
SM
SW-SM
ML
SM
GP-GM
B-2
CS-23
P-8
CONE RESISTANCE TSF(KG/CM²)
FRICTION RESISTANCE TSF(KG/CM²)
MS-C-22
MS-C-23
MS-C-24

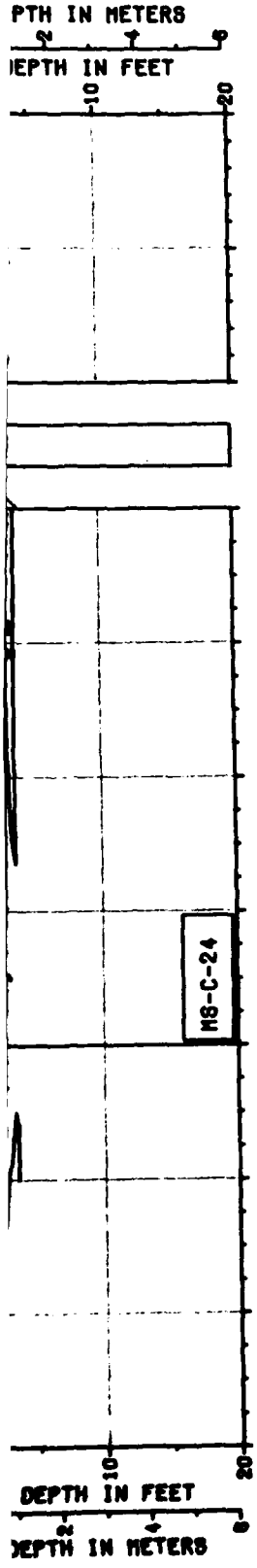


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FIGURE III-10-1

END

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